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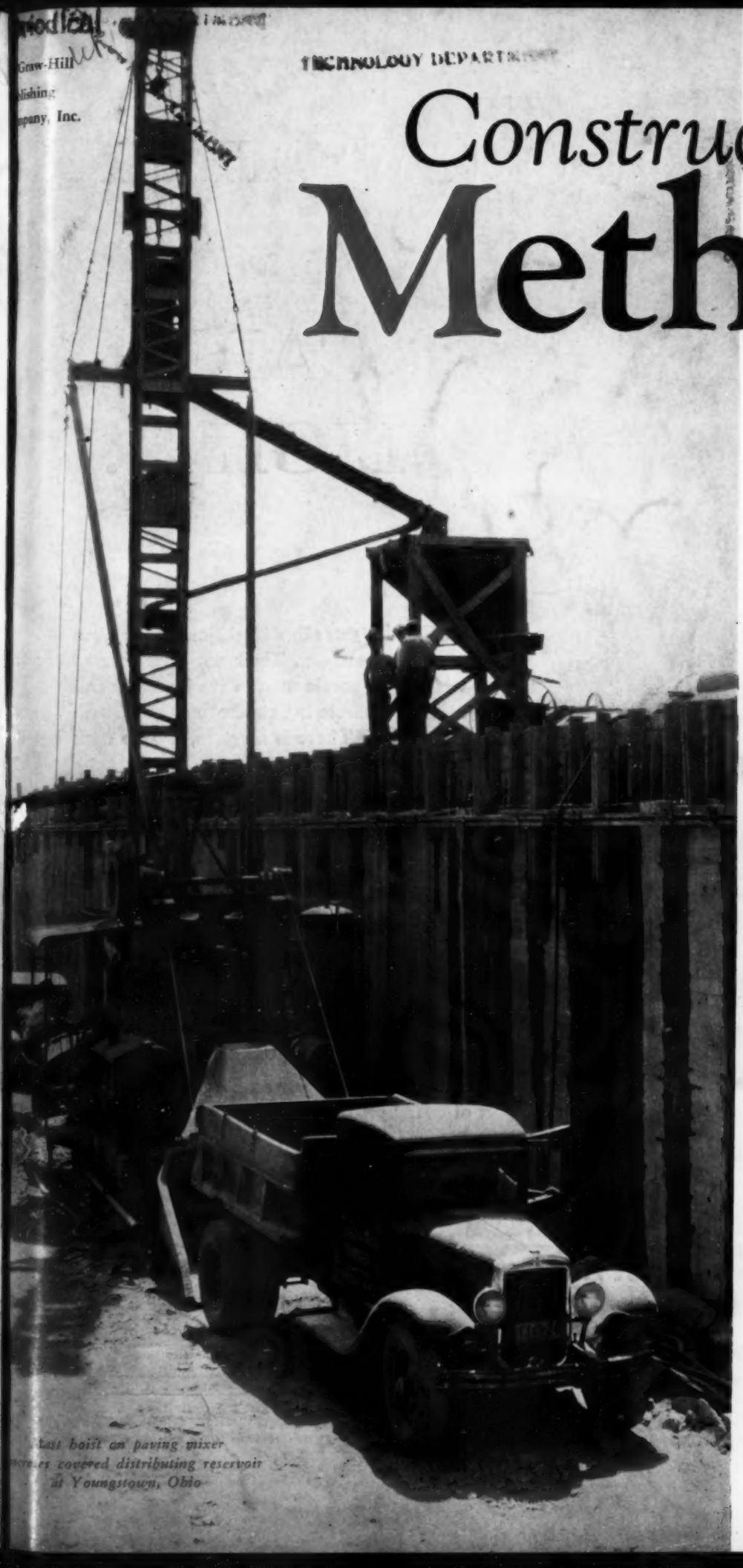
TECHNOLOGY DEPARTMENT

First Copy

October
1931

CUT 8 - 1931

Construction Methods



Last hoist on paving mixer ... covered distributing reservoir at Youngstown, Ohio

In This Issue:

Building Carpenter Dam, concrete structure 1,165 feet long with solid gravity spillway section 80 feet high, in Arkansas . . . By L. G. Warren, superintendent, Phoenix Utility Co.

Metal cribbing for retaining walls

Covered concrete distributing reservoir at Youngstown, Ohio

Motorized earth-moving equipment for Tennessee road building

Safety for building scaffolds

Watertight forms for concrete . . . By George Hockensmith, vice-president, Booth & Flinn Co.

Hoover Dam progress photographs

•

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

General Construction · Highways
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Carbic Flood Lights afford ideal illumination when night work is necessary. Their powerful rays of clear white light enable men to work rapidly and safely. They penetrate fog, smoke and dust to a remarkable degree. There is no glare, and no dark shadows.

Carbic Flood Lights operate equally well in hot or freezing weather. They stubbornly resist winds of almost gale force. Rain, snow, hail, or sleet, makes no difference. Reflectors are chromium plated—rust- and tarnish-proof.

The Carbic Flood Light is safe even under the most severe conditions. If it is accidentally upset, the water simply runs out, and gas generation stops immediately. It is listed as standard by the Underwriters' Laboratories, Inc.

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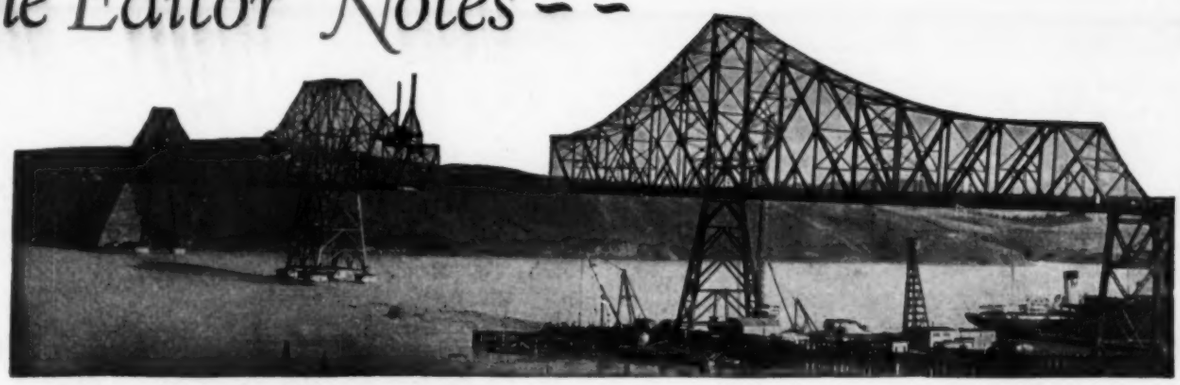
The new low price of Carbic is $6.00 a drum in Zone 1, $6.50 in Zone 2, and $7 in Zone 3. Write for Zone map.

CONSTRUCTION METHODS, October, 1931. Vol. 13, No. 10. Published monthly. McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y. $1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue, Vol. 8, No. 10, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

TECHNOLOGY DEPT.

The Editor Notes - -



Road Show in Detroit

FOR the 1932 convention and road show of the American Road Builders' Association, to be held in Detroit, Mich., Jan. 11-15, plans are already well advanced. The Municipal Airport Building will afford ample room, on a single floor, for an extensive exhibit of equipment and materials. Here engineers, contractors and public officials will have an opportunity of examining and comparing the new or improved products that manufacturers have developed for the road builder's use.

At the general convention sessions and in the various special group meetings the latest information on administrative, financial and technical practice will be presented. Of particular interest and value at recent conventions have been the reports of the association's many technical committees. Since last year's meeting at St. Louis committees of specialists in every phase of road building and maintenance have been active. What they will have to say at the Detroit convention in January should be well worth hearing. In view of present-day trends an outstanding committee report should be the one on construction and maintenance methods for low-cost roads.

All indications point to a large and representative attendance at the Detroit convention and show. If you are a road builder plan, now, to be there.

◆

Sand-Mastic Cushion for Brick Paving

Shifting or movement of the sand cushion or loss of sand through cracks in the concrete base are sometimes responsible for the development of rough, uneven areas in brick pavements. The trouble is being eliminated in recent brick paving construction by the use of cushion material with cementing value, enabling it to acquire some amount of structural stability.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD

J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

McGraw-Hill Publishing Company, Inc.

330 West 42d St., New York, N. Y.

For this purpose a sand-mastic cushion, although adding slightly to the cost, is finding favor among many engineers, who are using a commercial tar of a specific viscosity of 8 to 13. For sand-mastic cushion, the U. S. Bureau of Public Roads has adopted a mixture of 92 to 95 per cent sand and 8 to 5 per cent bituminous material, by volume.

◆

Fewer Accidents on Construction

From the National Safety Council, which held its annual congress and exposition in Chicago this month, comes news of progress in accident prevention in the construction industry. Based on reports of companies to the Construction Section of the Council accidents have shown a reduction of for the three-year period 1928-30, 14 per cent in both frequency and severity. This record, however, is considerably poorer than that of the entire group of 28 industries tabulated by the Council, which showed an average reduction of 28 per cent in accident frequency and 8 per cent in accident severity during the same three-year period.

Our New Address

This issue of *Construction Methods* comes to you from our new headquarters — the 33-story McGraw-Hill building just completed at 330 West 42d St., New York and described in our June and July numbers

Stalin on Wage Equalization

A SIGNIFICANT expression of opinion on the wage scale system prevalent in Russia is contained in a recent speech before the conference of industrial directors in Moscow by Joseph Stalin, general secretary of the Communist party of the Soviet Union. As reported by the *Economic Review of the Soviet Union*, Mr. Stalin said:

"In this period of extensive construction, when the scale of production has become gigantic and the technical equipment extremely complicated, labor turnover has become the foe of production, disorganizing our enterprises. Wherein lies the cause of this turnover? In the wrong wage-scale system, in the "Leftist" equalization of wages. In a number of enterprises our scales are so determined that the difference between skilled labor, between hard and easy work has almost completely disappeared. This equalization leads to a situation where the unskilled laborer is not interested in becoming skilled, having no perspective of advancement. Hence, he considers himself a "visitor" on the job, working only temporarily in order to save a bit and then going elsewhere 'in search of luck.' To do away with this it is necessary to eliminate the equalization of wages and the old wage scale. We must not tolerate a situation where a steel worker receives the same wage as a sweeper or a locomotive engineer the same as an office clerk."

◆

Arizona Contractors Must Be Licensed

A law providing for the licensing of contractors operating in the state was approved by the Arizona legislature recently. The new statute went into effect July 1. It is similar to the present California license law. The fee for a license is $25, and for renewal each year, $10.

The Stronger for What We Have Wrought

THROUGH flush times, good times or poor times, construction practice continues incessantly its march of progress.

Every day construction men somewhere are scheming and planning to do their next job quicker, better, more economically. Engineers are designing for higher efficiency in service and greater facility in construction. Manufacturers are building into their products the best thought of their laboratories, drafting rooms and shops; they are making available to both engineer and constructor improved materials, more productive equipment, more satisfactory distribution and servicing.

Under the spur of adversity such progress is more likely to accelerate than to languish. The need is more compelling, competition more challenging, the will to survive more dominant.

So the constructive industrial journal—that which seeks to live *for* its industry rather than *off* its industry—must carry on with its chronicle of progress and maintain untrammelled its exchange of ideas and experience for the benefit of those on the firing line.

Construction Methods values highly the comradeship with its readers, its contributors and its advertisers that has grown out of our common need and our common responsibility.

And when good times have come again, as they soon will, we all shall be the stronger for what we have lived and learned and for what we have wrought during these exacting days of searching test.

Willard Chevalier

Publishing Director.

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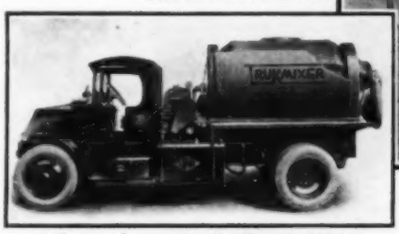
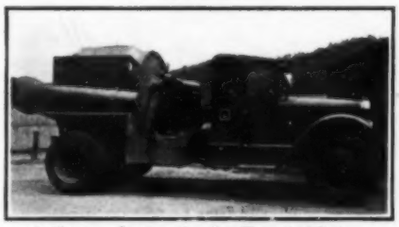
The BLAW-KNOX *profit producing* TRUKMIXER

for Highest Quality Concrete

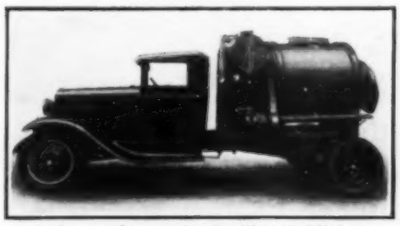
The Four-Point Discharge—the unique blade arrangements accomplish quick, clean and positive discharge of the concrete—without pulsation—controlled by a lever at the rear of the Trukmixer.



3-3½ cu. yd. capacity for Transit Mixing
6 cu. yd. capacity for Drum Type Agitation.



2-2½ cu. yd. capacity for Transit Mixing
3 cu. yd. capacity for Drum Type Agitation.



1-1½ cu. yd. capacity for Transit Mixing
2 cu. yd. capacity for Drum Type Agitation.

Here is the truck mixer you have been waiting for. Get the details of the exclusive features such as

. . . . end to end mixing
. . . . automatic drum reversal
. . . . automatic force feed water measurement
. . . . four point discharge
. . . . ultra rapid mixing action

The TRUKMIXER is a product of Blaw-Knox engineering, a concentration of years of experience and research in the manufacture of construction machinery.

Blaw-Knox Equipment for Ready Mixed Concrete includes:—

Trukmixer and drum type agitator.
Agitator (open type)
Batcherplants
Bulk Cement Plants
Weighing Batchers
Clamshell Buckets

The Blaw-Knox TRUKMIXER offers the highest quality construction combined with a reasonable selling price.

For complete details—send the coupon

BLAW-KNOX COMPANY
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Send complete information about the Blaw-Knox
TRUKMIXER.....cubic yard size

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BLAW-KNOX

Three Types—MIXER TRUCKS - DRUM TYPE AGITATORS - OPEN TYPE AGITATORS

ONLY THE BEST MOTOR TRUCKS CAN BUILD MODERN ROADS PROFITABLY

For ten years, Good Roads Engineering & Construction Company of Hempstead, Long Island, have found Autocars progressively efficient and profitable for road-building work. They own eight, of which this heavy-duty Model C is a modern example. Complete specifications of this truck may be had by writing The Autocar Company, Ardmore, Pa.

Concrete now cures faster than ever. Central-mixed and truck-mixed concrete speed up pouring. Modern graders prepare the bed faster. Lock-joint road forms are made ready for the concrete in a jiffy. All these things set a new pace for modern road-building. A faster pace. A pace the contractor's trucks must meet.

Today, the trucks of the successful contractor must cover ground faster and more dependably, with greater payloads, than any trucks have ever done in the past. They must not be cumbersome, lumbering things that merely *look* like a lot of motor truck.

The modern contractor's trucks must be heavy-duty trucks, of course. But they must also be quick and strong and easy to handle with the stamina to work night and day if necessary.

Only precision-built trucks can stand the pace. In the motor truck industry, no higher precision standards are maintained than those in force at the Autocar Factory.

It takes precision-built Autocars to build modern roads profitably. Buy them—for the safety of your investment.

AUTOCAR TRUCKS

PRECISION BUILT

THE AUTOCAR COMPANY, *Ardmore, Pa.*

A SHOVEL *with a* WOODEN LEG *or a* NORTHWEST?

WHY put up with "lame duck" crawler mechanisms that limp around the corner with less than half their tractive power when you need it most?

Whether a Northwest is going straight ahead or turning, *both crawler belts are being driven under full power!*

Here is traction that will steer under all conditions, slimy roads, mud to the top of the crawlers, stone strewn ground—positive traction on the turns as well as when going straight ahead.

It gives you greater turning power than any other crawler on the curves.

It makes possible longer crawlers and lower ground bearing pressure.

It reduces the terrific strains present where steering is accomplished by blocking one crawler.

It saves pavements and subgrade.

You need this traction on every job! It is one of the many features that make one out of every three Northwests a repeat order.

THIS IS PAGE 5

NORTHWEST ENGINEERING COMPANY

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

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HANDLE 25% HARDER DIGGING

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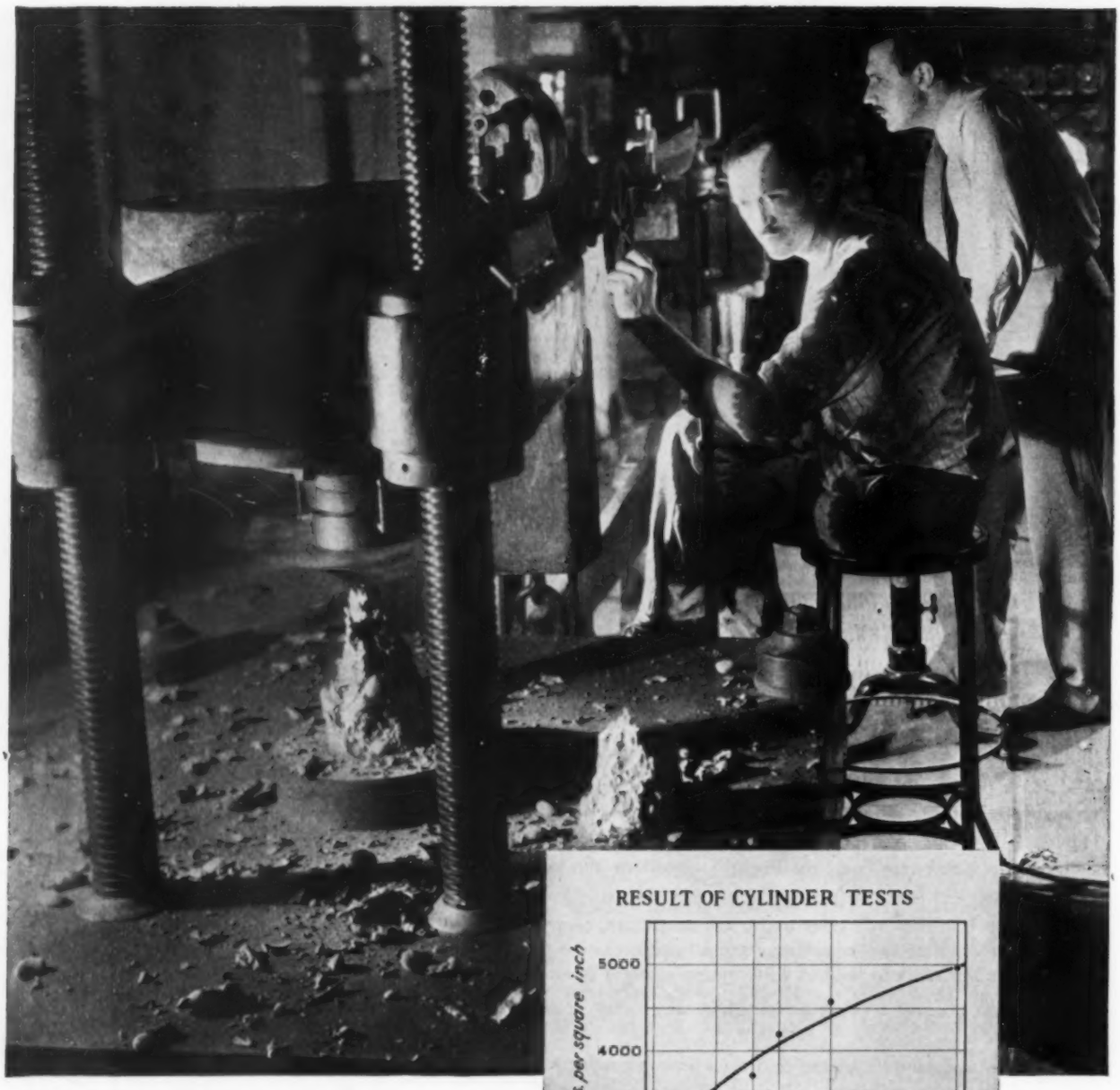
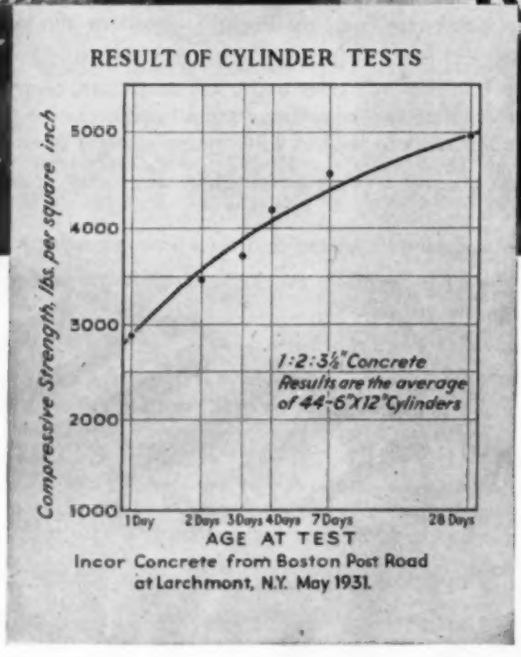
NORTHWEST

SHOVELS » CRANES » DRAGLINES » PULLSHOVELS » SKIMMER SCOOPS

"2940 pounds to





2940 POUNDS PER SQUARE INCH. The 24-hour old "Incor" cement concrete cylinder described on the opposite page withstood this pressure before breaking. The above photograph of the compression machine and broken specimen was taken immediately after the test.

Forty-four cylinders in all were tested, after curing under job conditions, at periods of one to twenty-eight days. The graph chart on the right shows the results.

the square inch!–

that will hold them."

Ready for traffic in 24 hours, "Incor" concrete saves local merchants $300,000

TWENTY thousand cars a day were being detoured round the main business section of Larchmont, New York, while the Boston Post Road was being repaved.

Transient trade was eliminated. Local trade was being diverted. The trade loss—more than $10,000 a day—was threatening the business life of the district.

To facilitate the job and restore normal traffic in 20 days instead of 3 months, the use of "Incor" was decided upon.

But the nights were cold and the engineers feared that sufficient strength might not be acquired in 24 hours to permit full traffic service.

BOSTON POST ROAD, LARCHMONT, N. Y. The use of "Incor"* Cement in repaving this section of highway reduced the necessary detour time at least *30 business days*, representing a saving to local merchants of $300,000.

Forty-four test cylinders were prepared on the job and cured under the same conditions as the pavement.

At the end of 24 hours 6 of these cylinders were tested. Engineers stood by as the crushing pressure was applied.

Farther and farther out on the beam moved the counterweight—past the minimum for full traffic service—past 70,000 pounds, past 80,000 pounds, until at 82,320 pounds the cylinder broke.

"TWO THOUSAND NINE HUNDRED AND FORTY POUNDS PER SQUARE INCH. *That will hold them!*" said an observer.

This 24-hour "Incor" concrete, despite cool weather, was already stronger than *any* traffic required.

Down came the barriers, down came the detour signs—and traffic took its normal course. A job that was to have taken 90 days was completed in 20.

Business came back at a bound. The Business Association and the Lions Club passed resolutions thanking the Mayor, the Engineers and the Contractor for their work.

Such was the result with "Incor" cement.

Had ordinary Portland cement been used, *under the most favorable conditions* normal traffic could not have been resumed for 30 business days longer, which at $10,000 a day would have meant an additional loss to the merchants of $300,000.

$300,000 saved at an added cost for "Incor" of $3512.

But what about the rest of the test cylinders?

Divided into 5 groups and broken at 2 days, 3 days, 4 days, 7 days and 28 days respectively, they revealed the following strengths:

At 2 days the average was 3478, at 3 days 3701, at 4 days 4181, at 7 days 4580, and at 28 days 4986, pounds to the square inch.

The graph chart on the opposite page shows the results, and represents the average of the 44 specimens.

"Incor" double burned cement contains 60% *more* tricalcium silicate and 75% *less* di-calcium silicate than ordinary Portland cements, which are single burned. That is why it makes better concrete and does the job in 24 hours instead of one or two weeks.

In 1928, "Incor" cost twice as much as Portland cement. Today the difference is so slight as to represent a small fraction of the economies it produces.

*Reg. U. S. Pat. Off.

INCOR *24-Hour Cement*

MADE BY THE PATENTED "DOUBLE BURNING" PROCESS

"INCOR" Cement is made by the producers of Lone Star Cement, under basic patents owned by International Cement Corporation, New York City

Ransome 27-E MASTER PAVER

Ransome Master Paver on Black Horse Pike near Folsom, N. J. S. J. Groves & Sons Company, Minneapolis, Minn., Contractors.

"FIRST Easy to Operate PRACTICALLY TROUBLE-PROOF"

"This new Ransome Paver has operated perfectly and we are making far better progress with our paving on this job than we have ever made on any other New Jersey State contract. The machine is fast, easy to operate and practically trouble proof." So say S. J. Groves & Sons Company about their new Ransome 27-E. Performance such as this is the kind that helps finish jobs *on schedule* and paves the way for future contracts.

The Ransome 27-E Paver included in your equipment is an invaluable asset as a contract clincher . . . Write for Bulletin 125.

Ransome Concrete Machinery Company

1850—Service for 81 Years—1931

Dunellen **New Jersey**

Factory rebuilt
Factory reconditioned

SHOVELS

DRAGLINES

CLAMSHELLS

CRANES

From the same dependable source as new Bucyrus-Erie machines

Rebuilt **machines purchased from the Bucyrus-Erie Company, carry the same guarantee as new machines. During rebuilding they undergo the same rigid inspection as new Bucyrus-Erie machines.**

When you buy a *reconditioned* machine from Bucyrus-Erie you buy a machine that has been carefully inspected in the factory and all parts showing undue signs of wear replaced.

There is nothing hit or miss about these types of machines sold by Bucyrus-Erie. The condition of each one is a matter of definite knowledge and is guaranteed to be as represented.

Look over the list printed here and let us tell you more about those that interest you.

Rebuilt or reconditioned machines

1—½-yard steam shovel
1—¾-yard gasoline shovel with clamshell equipment
1—⅞-yard steam shovel
1—1-yard gasoline shovel
1—1-yard Diesel shovel with dragline equipment
1—1¼-yard gasoline shovel with dragline equipment
1—1½-yard gasoline shovel with dragline equipment

Also a few unusual bargains in used machines

(Neither reconditioned nor rebuilt)
As is. F. O. B. present location.

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BUCYRUS-ERIE COMPANY, South Milwaukee, Wisconsin

Representatives throughout the U. S. A. *Branch Offices:* Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Kansas City, Mo., Dallas, San Francisco. Offices and distributors throughout the world.

1/2-yard
5/8
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7/8
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1-1/4
1-1/2
1-3/4
2
2-1/4
2-1/2
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3-1/2
4
4-1/2
5 and up to 16 yards

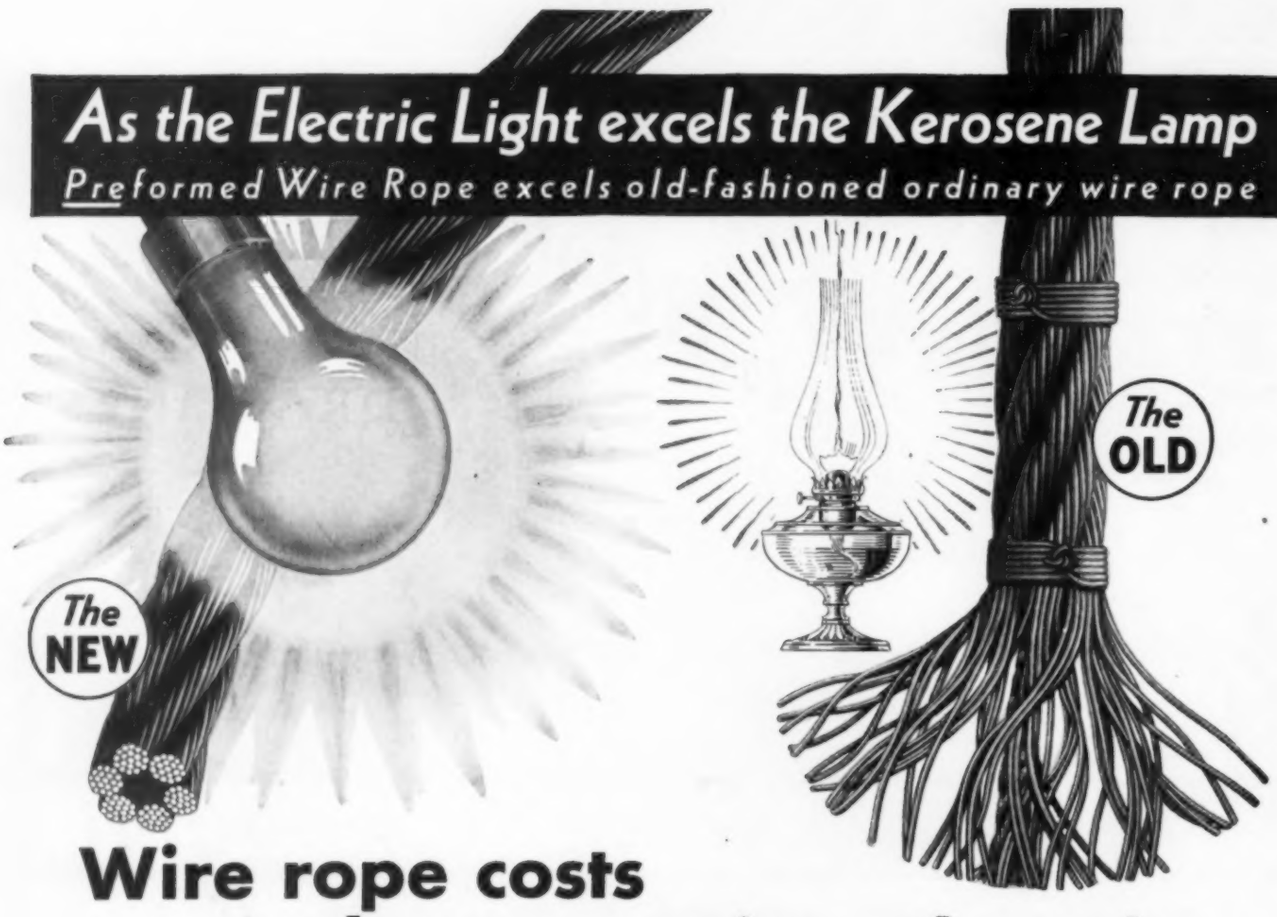
Shovels
Draglines
Clamshells
Lifting Cranes
Dragshovels
Magnet Cranes
Tunnel Shovels
Dredges
Dragline Buckets

Gasoline
Diesel
Gas + Air
Electric
Steam
Diesel-Electric

THIS is a real self-priming

As the Electric Light excels the Kerosene Lamp

Preformed Wire Rope excels old-fashioned ordinary wire rope



Wire rope costs deserve serious thought

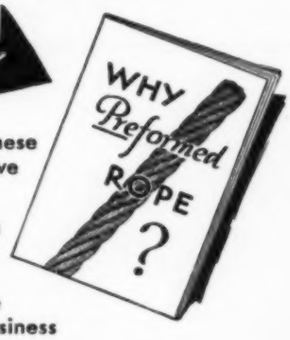
EVERY year many thousands of dollars are literally chewed up by internal stress in ordinary wire rope. Every year Tru-Lay Preformed Wire Rope is *saving* many thousands of dollars . . . because in Tru-Lay, internal stress is eliminated.

● Elimination of internal stress in wire rope is the first *basic* improvement in nearly a century. Service reports covering a wide variety of uses tell the story of 30% to 300% increased service. Whether these reports cover Tru-Lay service on power shovels or building elevators, rotary oil well drilling or hoists, Tru-Lay excels old-fashioned ordinary wire rope as the electric light excels the old-fashioned kerosene lamp.

● In Tru-Lay, internal stress is eliminated by preshaping the wires and strands so they lie naturally in position. Prove this by cutting Tru-Lay Preformed Wire Rope and note how the wires and strands lie normally in position.

● Then cut ordinary wire rope, and unless you seize the end with a firm wrapping of wire, the strands and wires straighten out and fly apart like a suddenly released clock spring. The difference is shown in the illustration above.

Send for this complete story



● 30% to 300% increased wire rope service is an important economic factor in these days when every dollar must give an accounting.

● Let us send you, or the man in your organization who is responsible for wire rope costs, a copy of "Why Preformed Wire Rope." Write for it on your business letterhead.

AMERICAN CABLE COMPANY, *Inc.*

New York Central Building, 230 Park Ave., NEW YORK CITY

District Offices: Chicago, Denver, Detroit, Philadelphia
Pittsburgh, Tulsa, San Francisco

The following manufacturers have been licensed to manufacture Preformed Wire Rope under the American Cable Company's Patents Nos. 1,513,583—1,518,253—1,643,150. (Other patents pending.)

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American Steel & Wire Co.
Broderick & Bascomb Rope Co.
E. H. Edwards Company
Hazard Wire Rope Co.
Pacific Wire Rope Co.

(In Canada)
Dominion Wire Rope Co., Ltd.
Anglo-Canadian Wire Rope Co., Ltd.
Canada Wire & Cable Co., Ltd.
B. Greening Wire Co., Ltd.

ACCO

An Associate Company of the American Chain Company, Inc.

TRU-LAY PREFORMED WIRE ROPE

30% to 300% Increased Service [*Depending upon the character of the service and type of equipment*

A *REAL* Self-Primer

THIS is a real self-priming centrifugal. It has no air pump, no floats, no air chambers, no gadgets, no automatic or hand operated discharge valve, no foot valves, no vacuum chamber.

It is simple, foolproof. It primes itself.

A four-inch outlet means a four-inch casing. A six-inch outlet a six-inch casing.

In other words, it is not a three-inch pump with a plug hat—or, in second case, a five-inch pump with a plug hat.

It has 25% more power than it will ever need in average service, to take care of overloads.

It handles big capacities. It primes fast.

That is the self-priming centrifugal developed by Pump Headquarters. It has been sold without "ballyhoo" to make sure it will do what contractors have a right to expect of it.

And every test has proved that here at last is a real self-primer. It really primes itself. See it today.

Come to Headquarters

ALABAMA: BIRMINGHAM
The Young & Vann Supply Co.

ALABAMA: MOBILE
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ARIZONA: PHOENIX
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ILLINOIS: PEORIA
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INDIANA: SOUTH BEND
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E. A. Sackerman & Co.

MICHIGAN: GRAND RAPIDS
Kellogg-Burlingame Company

MICHIGAN: JACKSON
Fred W. Lemcke

MINNESOTA: MINNEAPOLIS
H. E. Erickson Equip. & Supplies Co.

MISSOURI: JOPLIN
E. A. Martin Machinery Co.

MISSOURI: KANSAS CITY
English Brothers Machinery Co.

MISSOURI: ST. LOUIS
Fickeissen-Finney Equipment Co.

MISSOURI: SPRINGFIELD
E. A. Martin Machinery Company

MONTANA: BUTTE
Hall-Perry Machinery Company

NEBRASKA: OMAHA
Interstate Machinery & Supply Co.

NEW YORK: ALBANY
Thos. Smyth

NEW YORK: ALBANY
R. B. Wing & Son

NEW YORK: BUFFALO
Dravo Equipment Co.
Wheeler Equipment Co.

NEW YORK: LONG ISLAND CITY
E. B. Kelly Co., Inc.

NEW YORK: NEW YORK CITY
Novo Engine Company

NEW YORK: NEW YORK CITY
John Reiner & Company, Inc.

NEW YORK: SYRACUSE
Buell Equipment Corporation

NORTH CAROLINA: RALEIGH
Raleigh Tractor & Equipment Co.

OHIO: CINCINNATI
The Mechanical Supplies Co.

OHIO: CLEVELAND
Dravo Equipment Company

OHIO: COLUMBUS
The Taylor Tractor Co.

OHIO: TOLEDO
The National Supply Company

OKLAHOMA: OKLAHOMA CITY
Wylie-Stewart Machinery Co., Inc.

OREGON: PORTLAND
Western Road Machinery Co.

PENNSYLVANIA: PHILADELPHIA
Reeves-McCormick, Inc.

PENNSYLVANIA: PITTSBURGH
Dravo Equipment Company

SOUTH CAROLINA: COLUMBIA
Tidewater Supply Company, Inc.

SOUTH DAKOTA: SIOUX FALLS
Western Material Company

TENNESSEE: JOHNSON CITY
Summers Hardware Company

TENNESSEE: KNOXVILLE
Dempster Equipment Company

TENNESSEE: MEMPHIS
Pidgeon-Thomas Iron Company

TEXAS: DALLAS
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TEXAS: EL PASO
Don A. Carpenter & Company

TEXAS: HOUSTON
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San Antonio Machine & Supply Co.

UTAH: SALT LAKE CITY
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VIRGINIA: NORFOLK
Tidewater Supply Company, Inc.

VIRGINIA: RICHMOND
James McGraw, Inc.

VIRGINIA: ROANOKE
Southern Machinery & Supply Co.

WASHINGTON: SEATTLE
Star Machinery Company

WEST VIRGINIA: BLUEFIELD
Bluefield Supply Company

WEST VIRGINIA: CHARLESTON
Baldwin Supply Co.

WEST VIRGINIA: HUNTINGTON
Banks-Miller Supply Company

WISCONSIN: MILWAUKEE
W. A. Nelson Equipment Co.

CANADA: B. C.: VANCOUVER
B. C. Equipment Company, Ltd.

CANADA: MAN.: WINNIPEG
Powell Equipment Co., Ltd.

CANADA: ONT.: LONDON
London Concrete Machinery Co., Ltd.

NOVO

Headquarters for Pumps

NOVO ENGINE COMPANY

Clarence E. Bement, Vice-Pres. and Gen. Mgr.

214 Porter Street, Lansing, Michigan

and

discuss

"STABLE-ARC"

"It seems to me that all welders have a stable arc, according to the advertising I read."

"There's only one 'Stable-Arc,' that's Lincoln's."

"Can you prove that to me?"

"You can prove it yourself by asking those who own Lincoln welders and other makes, which make of welder they prefer and why."

"Evidently the answer to that would explain why I see more Lincoln 'Stable-Arcs' in use than any other make."

"Not entirely—the Lincoln 'Stable-Arc' welder also has dual control of welding heat . . . a separately excited generator field . . . sparkless commutation . . . simplified and unified control, right up where it's handy . . . and all steel construction. No other welder has all these features. There's only one name for this unbeatable combination of features in a welder—and that's

LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Largest Manufacturers of Arc Welding Equipment in the World W-188

"HERCULES" (RED-STRAND) WIRE ROPE

REG. U.S. PAT. OFF.

is built up to

correctly established standards

The quality of "HERCULES" (Red-Strand) Wire Rope is not a matter of chance, but the result of definite and specific causes. **** In the first place, it is made of acid open hearth steel wire; then, each wire used is rigidly tested by us to make sure that it meets our exacting standards in every detail. **** Tests mean nothing unless the standard is first correctly established and then strictly adhered to. Our standards are the result of our long experience in making wire rope for hard work of all kinds.

There is a Leschen Distributor and a stock of Leschen Wire Rope at over 100 different points. The name of our Distributor in any particular locality will be furnished gladly upon request.

Made Only by

A. Leschen & Sons Rope Co.

Established 1857

5909 Kennerly Avenue

ST. LOUIS, MO.

New York - - - - - - - - Chicago

Denver - - - - - - - San Francisco

Pulling 14 in. arch web Lackawanna Piles, 30 ft. long from the cofferdam of the Holyoke Water Power Co.

P. J. Kennedy & Co., Inc., Holyoke, Mass., Contractors.

"Much favorable comment"

"The machine has performed very satisfactorily, and has come in for *much favorable comment.*"

So says P. J. Kennedy & Co. of Holyoke, Mass. speaking of their new Vulcan Pile Extractor.

And such comment is far from unusual when the Vulcan Extractor is the subject of conversation.

All of which goes to prove that the Vulcan principle of a single purpose machine is correct. Vulcan Extractors are always ready for service and require no tedious adjustments as in the case of a combination driver and extractor.

There is no compromise in the design of the Vulcan Extractor, it is built for the sole purpose of pulling piling—and does its job superlatively well.

VULCAN IRON WORKS
327 N. IRVING AVE., CHICAGO, ILL.

Representatives for California, Nevada, and Japan:
Harron, Rickard & McCone Co.,
1600 Bryant St., San Francisco, Calif.

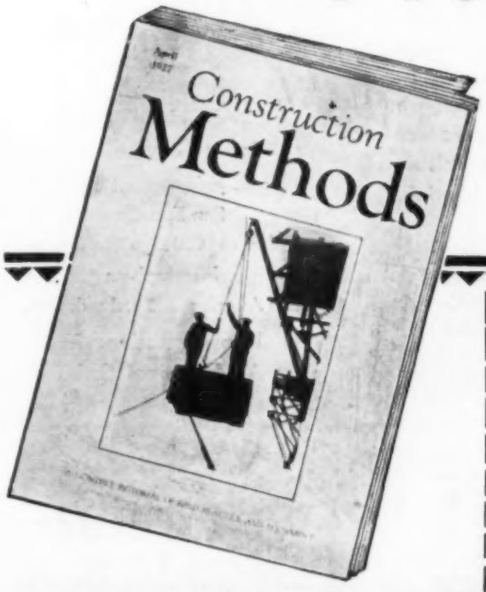
Southern Representatives:
Woodward, Wight & Co., Ltd.,
451 Howard Ave., New Orleans, La.

Representatives for Washington and Oregon:
A. H. Cox & Co.,
1757 First Ave., South,
Seattle, Wash.

THE VULCAN EXTRACTOR

Are You Interested In!

Saving time and money on the job?
New Construction ideas?
More profit from each contract?
Speeding up Construction?
Using equipment to better advantage?



You will find the answers to these questions each month by subscribing to your own copy of Construction Methods.

Fill Out This Coupon—NOW

CONSTRUCTION METHODS, Tenth Ave. at 36th St., New York, N. Y.

All Right. Here's my money for my own subscription to Construction Methods. One Year (12 issues) $1.00

Name.....

Address.....

City..... State.....

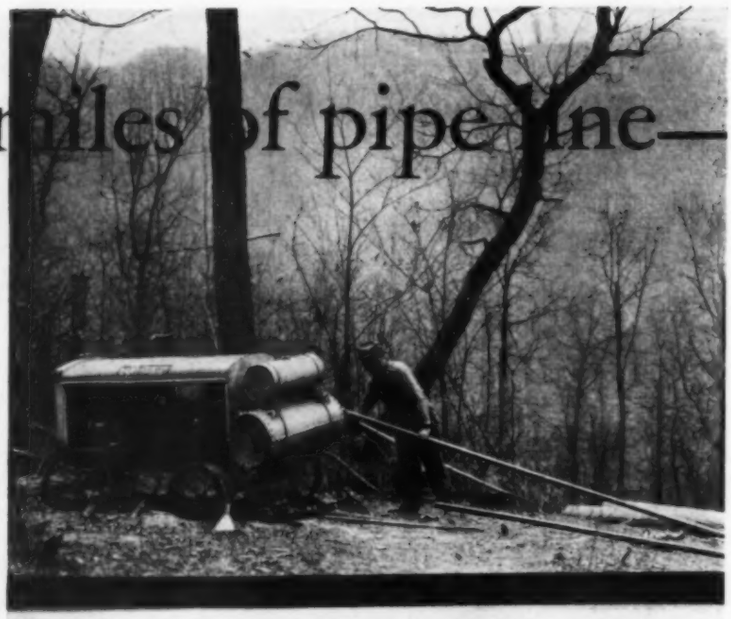
Company Employed by or Business Connection.....

Nature of Business..... Title.....

Please Fill In Every Line

CM-Ad-8

Hundreds of miles of pipe line—



53 Schramm Compressors

Fifty-three compressors on one job—including the No. 120, 240 and 360 cu. ft. sizes. Big compressors for the big jobs—smaller sizes for the small jobs—but everyone a SCHRAMM.

All of these compressors used by the Columbia Gas Construction Co., who are extending pipe lines from the Kentucky gas fields to the Atlantic seaboard. The first order called for seven SCHRAMM compressors. Rock was encountered everywhere . . . rivers to cross . . . mountains to go over . . . forests to cut through. There was demand for more compressors and the answer was "get SCHRAMMS"—until finally fifty-three compressors were on the job.

Which is another instance where SCHRAMM users are SCHRAMM buyers! Repeat orders invariably follow when SCHRAMM Compressors go to work on a big job.

Buy PERFORMANCE when you buy compressors . . . buy EFFICIENCY . . . buy SATISFACTION . . . buy SCHRAMM Compressors. Send for the catalog.

TRADE SCHRAMM AIR COMPRESSORS MARK

BRANCH OFFICES:
New York
Philadelphia Pittsburgh
San Francisco
Tulsa Chicago Boston
Birmingham
Los Angeles Portland, Ore.
Representatives in
All Principal Cities

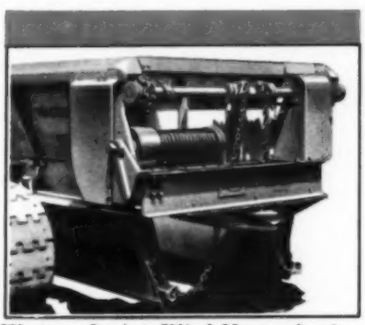
Schramm Inc.

West Chester
Penna., U. S. A.

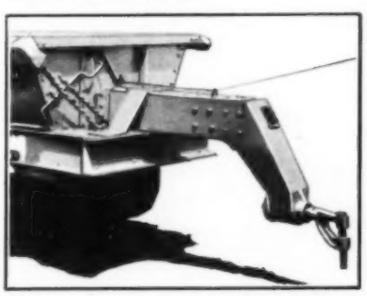
Astonishing new
WESTERN SPRING WIND-UP
saves cost of wagon man!

No wagon man needed with Western Crawler Wagons equipped with Spring Wind-Up. Dump boss or tractor operator trips loads and winds up doors.

Speeds production . . . Acts instantly . . . Closes doors tightly . . . *All Western Crawler Wagons can be equipped!*



Western Spring Wind-Up mechanism on direct-hitch wagons (with dust-proof guards removed) in position assumed when doors are opened.



Western 5-yard Crawler Dump Wagon with direct-hitch, equipped with Spring Wind-Up—front view. Note lever and rope control and lever arm held close to wagon.

NOW contractors can actually add money to their profits that used to be spent for an extra man to trip loads and wind doors!

This important saving is made possible by the remarkable new Spring Wind-Up for Western Crawler Dump Wagons. It is a simple, easily operated door control device that can be readily attached to both direct-hitch or front truck wagons and needs no special connections on the tractor.

No complicated mechanism or outside power is required. Gravity and spring action do all the work and it operates equally well at all temperatures. A single pull on a rope running to the tractor, or a single pull on the lever by the dump boss trips the load. A second pull closes the doors after the wagon has moved free of the dumped load. A large torsion spring closes the doors instantly even under the severest conditions.

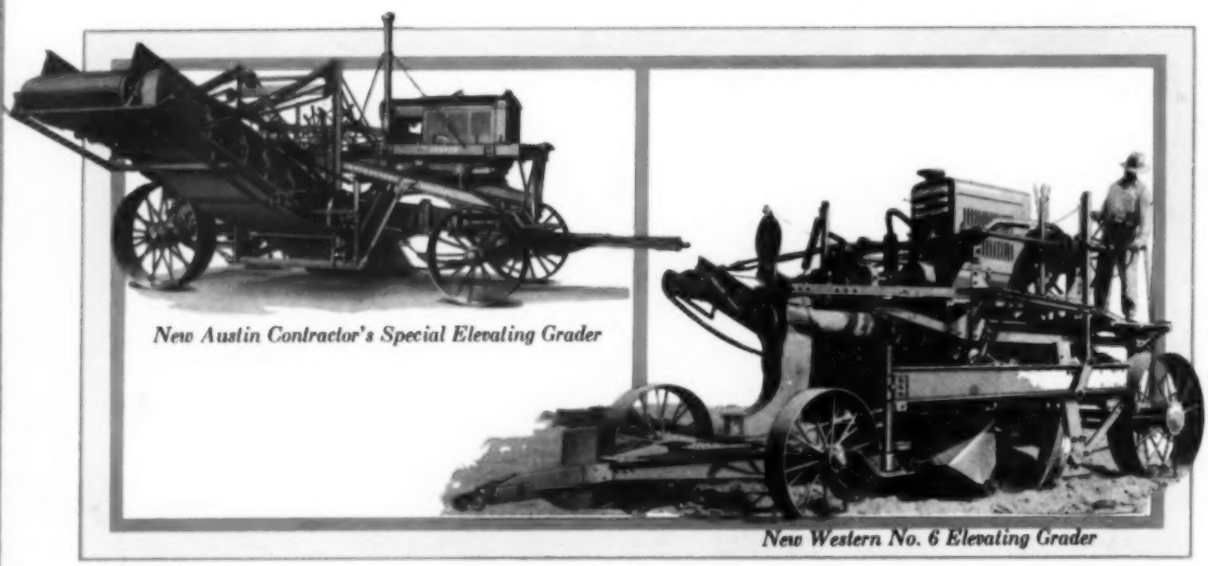
This instantaneous action enables Western Crawler Dump Wagons to be used on even the shortest hauls without having to wait for the door wind-up! On *all* hauls the new Spring Wind-Up is ready for reloading more quickly—increasing daily yardage. Write today for facts about the Spring Wind-Up on new or present equipment. The Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill. Branches in principal cities.

AUSTIN-WESTERN ROAD MACHINERY COAST TO COAST

Austin-Western
ROAD MACHINERY

GREATER CAPACITY

. . . more dirt per minute means lower costs per mile



New Austin Contractor's Special Elevating Grader

New Western No. 6 Elevating Grader

New Austin Contractor's Special Elevating Grader with 42" engine driven carrier and anti-friction bearings.

More than meeting modern earth moving demands—this is beyond all question THE FINEST AUSTIN ELEVATING GRADER EVER BUILT. Its great strength, large capacity output, smooth operation and durability are obvious when you've looked it over and seen it perform.

The motor driven carrier enables the grader to develop maximum capacity regardless of soil conditions. Saves idling after rains or other adverse conditions.

Other improvements include: longer guard rollers under discharge to avoid damage from wagons—heavier supporting chains—higher steel side boards, improved all-metal belt drums—sturdier frame—larger plow beam and a stronger engine hitch. Austin Elevating Graders are also supplied with power take-off or rear wheel drive in various sizes.

New Western No. 6 Elevating Grader with hand-operated plow, engine driven carrier and anti-friction bearings.

With the new Western No. 6 Elevating Grader, too, the full power of the tractor can be utilized for plowing. A 35 hp. engine mounted on the machine operates the carrier.

A 10-inch steel tube "backbone" provides a powerful frame that will stand the twisting strains from a heavy load on the carrier. The three-point suspension system upon which this giant elevating grader is designed further eliminates the possibility of frame distortion and resulting "floating" belt trouble. It will operate without difficulty wherever crawler-type equipment can travel.

Other details that add to its strength and capacity are: a girder front axle and "H" beam tongue with a powerful coil spring to take up starting shocks, a ball and socket front end, a new control for plow that regulates pressure and permits of cutting harder ground than ever before.

Write for complete information

THE AUSTIN-WESTERN ROAD MACHINERY CO.

400 North Michigan Avenue • CHICAGO, ILLINOIS • *Branches in principal cities*

Leaning Wheel Graders, Straight Wheel Graders, Motor Graders, Elevating Graders, Crawler Dump Wagons, Scarifiers, Rock Crushers, Portable Conveyors, Rollers, Motor Sweepers, Street Sweepers, Sprinklers, Road Oilers, Hot Patch Portable Asphalt Plants, Plows and Scrapers.

MEASURE YOUR CLAMSHELL BUCKET ON ITS DAY-BY-DAY EARNING CAPACITY

Base your conclusions on its ability as a producing worker

The clamshell bucket that pays best is the bucket that always does "a bigger day's work"—*That's an Owen!*

The bucket that earns its cost over and over again is the bucket that saves most time by making shortest work of every job. *That's an Owen!*

The bucket that is a money earner for its owner is the bucket that keeps down operating costs on this job, and that job, and the next job—any job——no matter what the work or the condition. *That's an Owen!*

A sound investment in all respects—with bigger and better returns not only assured—but guaranteed. *That's an Owen!*

What's your work for a clamshell bucket? Tell us in a short note and we'll send you detailed information on the Owen that will handle it at lowest cost.

THE OWEN BUCKET CO.
6023 Breakwater Ave., Cleveland, Ohio

A Mouthful at Every Bite..

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAY'S WORK

Owen Buckets

Clear the decks

McGRAW-HILL

McGRAW-HILL PUBLISHING CO., Inc., New York · Boston · Philadelphia · Washington

Business men, industrialists and engineers—600,000 of them—regularly read the McGraw-Hill Publications. More than 3,000,000 use McGraw-Hill books and magazines in their business.

The Business Week
System

Factory and Industrial Management
Maintenance Engineering

American Machinist
Product Engineering

Engineering News-Record
Construction Methods

but don't throw the cannon overboard!

When the real test comes, all the paraphernalia of peacetime, all the decorations that shine in reviews, are thrown aside. Decks are cleared, men are stripped for action. Only the essentials of battle—manpower and guns—remain.

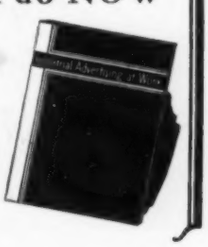
Business today is facing its real test. All the methods that merely help business "dress up", that just arouse public admiration, must be discarded. Today there's room on the deck for only the real sales weapons—manpower and *advertising that shoots straight at its prospects.*

For those who sell to business and industry the McGraw-Hill business publications are the essentials of battle. They're aimed straight at your prospects—over half-a-million men of business and industry who impulse and control buying. They are used as buying guides by 69% of the executives questioned recently. Clear the decks for this battle, *but don't throw the cannon overboard!*

★2 **Jobs that business paper advertising can do NOW**

There are ten ways in which business paper advertising can help your salesmen get orders . . . today. Here's one.

★*It can hurdle the barrier of distance — keep your story before far-away prospects between the salesmen's calls.*



This and the other uses of business paper advertising are explained in our book, "Industrial Advertising at Work." Our representative will gladly bring you a copy on request.

PUBLICATIONS

Greenville · Cleveland · Detroit · Chicago · St. Louis · San Francisco · Los Angeles : London

Engineering and Mining Journal
Engineering and Mining World
Metal and Mineral Markets
Coal Age

Electric Railway Journal
Bus Transportation
Aviation
Textile World

Electrical World
Electrical Merchandising
Electrical West
Power

Radio Retailing
Electronics
Food Industries
Chemical & Metallurgical Engineering

1 of Three

This Bay City Model S, one-yard full revolving Shovel is handling 60" steel pipe into an 8' trench, on a Section of the Main Water Line for the City of Boston, between West Newton and Watertown, Mass. During the week of Sept. 5, McCue's three Bay City Machines set a record for the entire job by laying 1,017 feet.

IN USE BY

Mr. McCUE

Watertown, Mass.

Let us add that Mr. Thomas McCue also used a Bay City Model 16-B ¾ yd. trench hoe to excavate the trench . . . and likewise owns a Bay City full revolving ½ yd. Model K2 which he used for other crane work.

The complete Bay City line consists of 6 different type and size machines, ranging from ½ to one yard capacity as follows:

½ yd. Tractor Shovel and rubber tire mounted Cranemobile.
Light, half yard revolving Model K. Full half yard revolving Model K2.
Three-quarter yard, heavy duty, revolving Model R and one yard revolving Model S.

BAY CITY SHOVELS, Inc.

EASTERN OFFICE
9 Westfield Ave., Roselle Park, N. J.

BAY CITY, MICH.

BAY-CITY SHOVELS

THE BAY-CITY FAMILY
OF FAST WORKERS

THEW LORAIN

A Size and Type Machine for Every Job

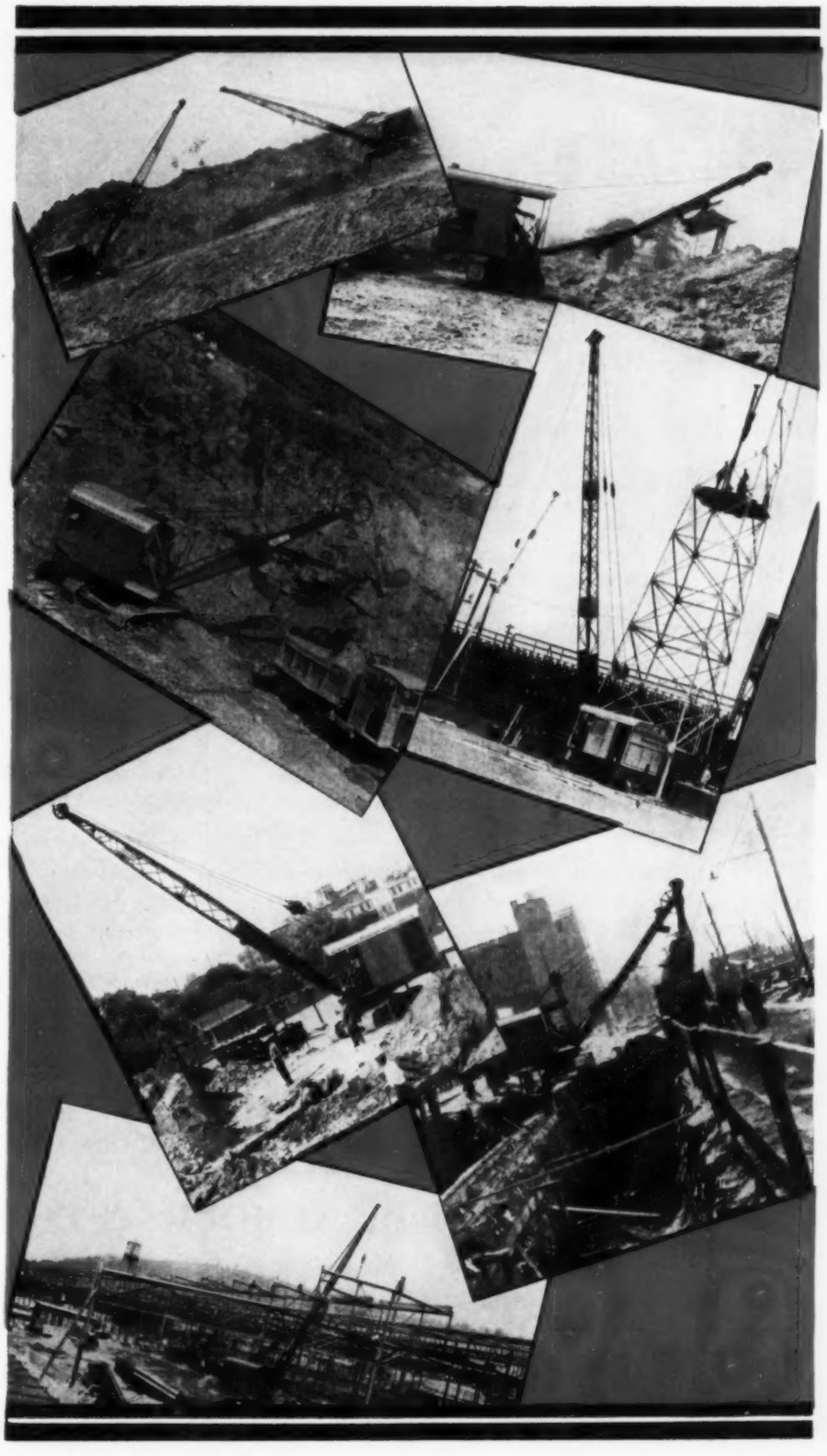
¾ — 1 — 1¼ — 1½ Yard
"Center Drive"
Shovels
Clamshells
Draglines
Backdiggers
Skimmers
Cranes

15—20—25 Ton
Locomotive
Cranes

Gas, Diesel, Electric

½ Yard
Universal Crawler Units

THE
THEW SHOVEL CO.
Lorain, Ohio



Use du Pont **DYNAMITE** *to displace unstable material below Highway Fills to make* **PERMANENT ROADS**

DYNAMITE has found a new job. Today, on thousands of miles of highways, it is helping to simplify one of the most difficult tasks highway construction engineers have to encounter—building roads across swamps and marshes.

The methods of using dynamite are variable and can be applied in almost any locality. Here are three methods that have been successfully used:

1. The first method is to blast with du Pont Ditching Dynamite as large a ditch as possible along the center line of the projected highway. Such a ditch may be thirty feet wide and eight feet deep. The fill is then put in the ditch and piled up in sufficient quantity as to cause a considerable natural settlement, due to its weight, through the remaining unstable material. Blasting a ditch has two functions, first to throw out as much material as possible and second to liquefy or stir up the remaining material so that it can be readily pushed aside by the weight of the fill.

2. The second method is to place the required fill on the top of the marsh and load the dynamite in the mud or muck beneath the fill. Because of the water content of the underlying material, du Pont 60% Gelatin is recommended for this work. The force of the explosion pushes the muck aside and the fill settles in place. Here again the dynamite has two functions, first to create a cavity for the fill to drop into, and second to semi-liquefy the remaining muck.

3. The third method is to use du Pont Ditching Dynamite to shoot ditches on either side of the new fill after it has been put in place, in order to relieve the pressure so that the weight of the fill can more easily push out the underlying mud. When the muck is deep, the ditches are not sufficient and extra loads of du Pont Ditching Dynamite are placed in the ditch line at a depth below the bottom of the fill, so that the resulting explosion will force the remaining material out on either side of the fill. This method particularly applies when the fill material is clay and, therefore, will not flow readily.

These three methods may be combined or suitably varied to meet any local condition or problem.

Our explosives engineers are observing and reporting on fill settlement projects in many sections of the country. Their findings are available to engineers, contractors and officials engaged in constructing and maintaining highways. Your inquiries and problems are invited in the interest of better highways, lower maintenance costs and public satisfaction.

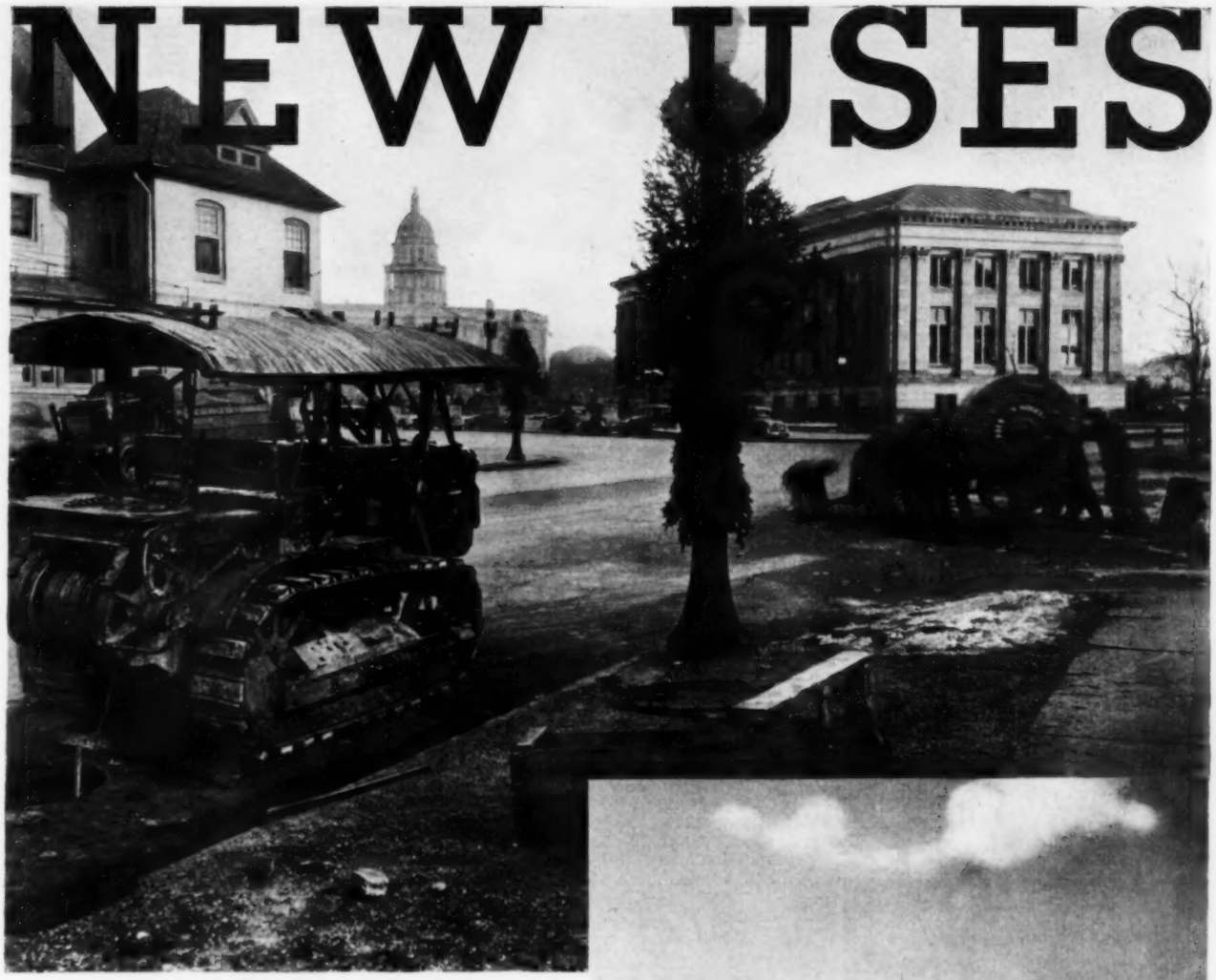
DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY, Inc.

Explosives Department • **Wilmington, Del.**

DU PONT EXPLOSIVES

NEW USES



A "CATERPILLAR" pulling electric light cable into place under Denver's streets

and

Another "Caterpillar" unreeling five reels of 8000-ft. cable in one pull — a chore on the Bagnell Dam construction in Missouri

and

Most any task where plentiful power, responsive control and ample traction must join hands to cut time and costs.

Prices — f. o. b. Peoria, Illinois

TEN	$1100	TWENTY	$1900
FIFTEEN	$1450	THIRTY	$2375
SIXTY	$4175		

Caterpillar Tractor Co.

PEORIA, ILLINOIS, U. S. A.

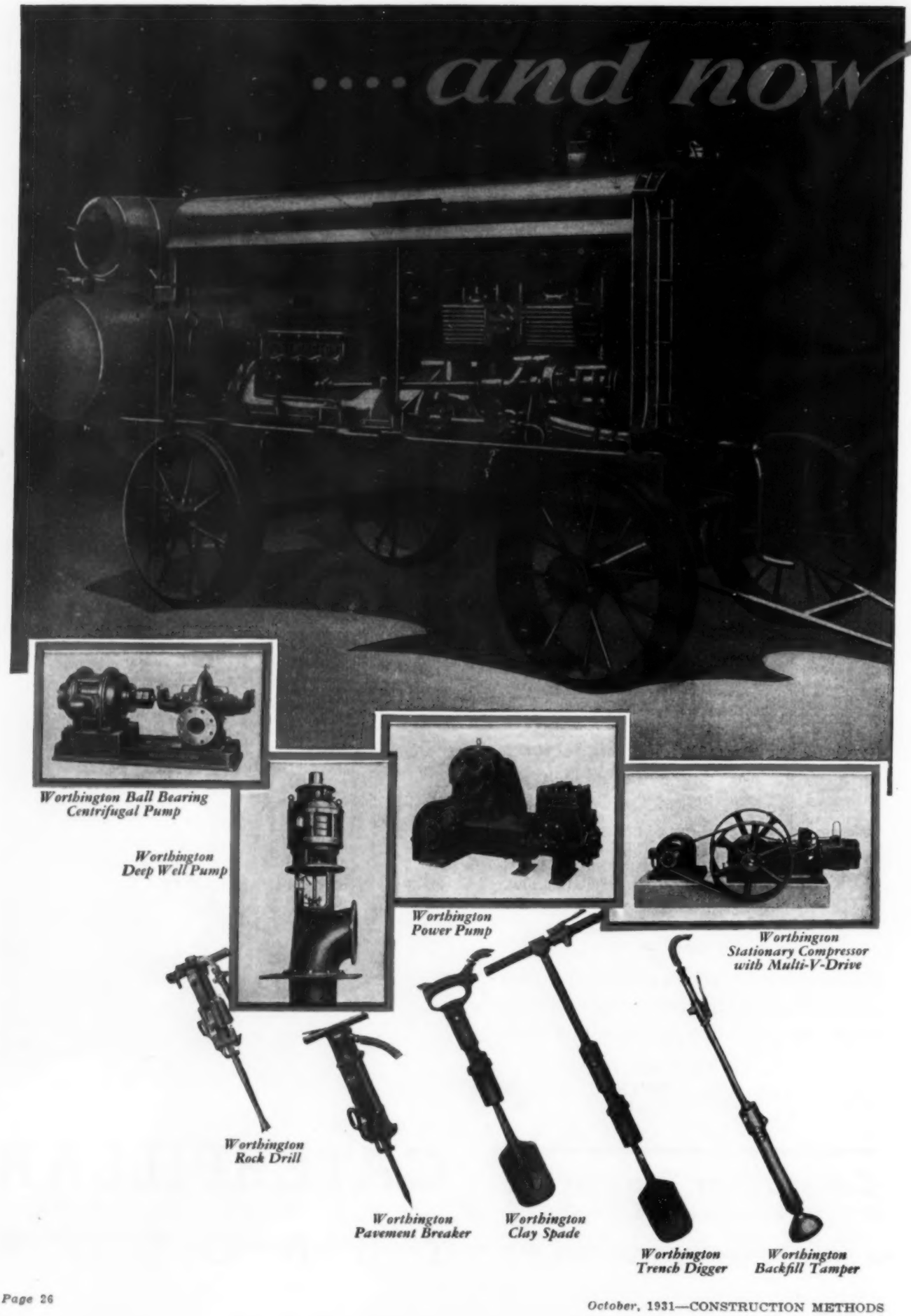
Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR



Worthington Ball Bearing Centrifugal Pump

Worthington Deep Well Pump

Worthington Power Pump

Worthington Stationary Compressor with Multi-V-Drive

Worthington Rock Drill

Worthington Pavement Breaker

Worthington Clay Spade

Worthington Trench Digger

Worthington Backfill Tamper

METALWELD-WORTHINGTON

becomes

WORTHINGTON

to round out our service to Construction and Maintenance

FOR eighty-six years Worthington has built pumps; for forty-one years, compressors. Last year the Gilman line of contractors air tools and rock drilling equipment became a member of the Worthington family.

And now . . . to further extend this group of equipment for contractors, public utilities, railroads and industrial plant maintenance . . . the Metalweld-Worthington line of portable air compressors has been added.

Worthington Compressors have been used exclusively in Metalweld-Worthington portable units, and have been recognized as an important factor in building world-wide prestige for this equipment.

Present users are assured of the unlimited backing of the Worthington organization. To industry at large we offer an improved line of quality compressors in a wide range of sizes . . . for trailer, motor truck, tractor, rail car and semi-portable mountings; also a complete group of contractors air tools, including rock drills, pavement breakers, clay spades, trench diggers, backfill tampers, drill steel, air hose and all accessory equipment.

Back of this equipment are the traditions of the Worthington organization. The advantage to the buyer is obvious . . . one source of supply with *One Policy of Complete and Undivided Responsibility* for the successful operation of pumps, compressors, air tools and accessories. Equipment users have learned the significance of Worthington's broad protective guarantees. Worthington products *must* deliver the performance promised for them.

A nation-wide dealer organization, working with Worthington district offices, will engineer, distribute and service this expanded line of products.

COMPRESSORS *Portable and Stationary*	PUMPS *Centrifugal...Steam...Power Rotary...Deep Well*
ROCK DRILLING EQUIPMENT	FEEDWATER HEATERS
Rock Drills	CONDENSERS and Auxiliaries
Contractors Air Tools	METERS *Water...Grease Oil...Gasoline*
Drill Steel and Accessories	DIESEL ENGINES
Automatic Heat Treating Machines	GAS ENGINES
Forging Furnaces	CHROMIUM PLATING
MULTI-V-DRIVES	*Literature on request*

ATLANTA
BOSTON
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DETROIT
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KANSAS CITY
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SAN FRANCISCO
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ST. LOUIS
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NEW ORLEANS
NEW YORK
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Branch Offices or Representatives in Principal Cities throughout the World

WORTHINGTON PUMP AND MACHINERY CORPORATION

Works: HARRISON, N. J. CINCINNATI, OHIO BUFFALO, N.Y. HOLYOKE, MASS.
Executive Offices: 2 PARK AVENUE, NEW YORK, N. Y. *General Offices:* HARRISON, N. J. G-93

FIX RESPONSIBILITY ON ONE RELIABLE MANUFACTURER . . . WORTHINGTON

Work for All

SHALL next winter's unemployment emergency be relieved by work or by charity? This question, which we asked two weeks ago in urging public works for relief, is now the outstanding question of the day. The emergency has been brought into sensational prominence by the President's step in organizing nationwide charity relief measures. As yet nothing has been done toward mobilizing increased public works.

The President's extragovernmental organization is a reminder of wartime methods. And in a very real sense we are again at war—fighting to overcome the menacing effects of economic breakdown and win back for all the people the opportunity for self-support. If so, let wartime methods be applied purposefully, by overcoming idleness rather than by compromising with it. The outcome is sure if the fight is pressed intelligently and unitedly. At a time when our national resources have been developed to unparalleled richness it is unthinkable that we should yield to distress, or allow large numbers of the people to be demoralized by charity.

Public works can employ the idle and can make available to them, not by gift but by right of labor, the stores of food, clothing and shelter of which the country has abundance. Private business has proved powerless to maintain the workers at their jobs. The great resource of public work remains.

IS THIS resource sufficient? There are those who say that the great volume of public works required to meet the emergency does not exist, and that therefore we must resign ourselves to the charity plan. They disregard the facts.

Construction needs exist in prodigious volume. The country's annual budget of public-works construction approaches three and a half billion dollars. An addition of little more than twice this amount will give work to five million men at an expenditure of $1,500 per man for labor and materials. Less will do, in fact. Large numbers are engaged behind the lines: the supply, housing and service workers whose employment results from that of the direct producers; construction payrolls need not provide for these. It is quite likely that mere doubling of the volume of public-works construction for a year would provide a job for every seeker.

LET US make the picture specific. Road work alone could take care of the entire unemployment emergency, were no other source of work at hand. More than two million miles of road in the United States still want improvement from the dirt-road stage. Reasonable modernization of but half or a third of that mileage within a year would enlist the service of every unemployed worker. Tools might prove short at the start, but they could be provided.

But such intensive use of a single resource is not necessary. Many roads are remote, and the unemployed have gathered largely in the cities. They can find quite as much work close at home.

Cities can make available a vast total of urgent work —street widening and paving, modernization of public buildings, sewer and water improvement and the bettering of medieval conditions in dozens of directions. If nothing more were done than to safeguard, reconstruct and render decently habitable the notoriously unfit institutional buildings throughout the land, it would absorb a large contingent of the idle.

In brief, the volume of needed public works is ample to provide the employment by which the emergency can be met in full. Every state, county and city has its quota. There is federal construction also, but this is only a tenth of the country's annual public-works budget. The great bulk of emergency construction will come from the states and local communities.

WE ARE not forced to depend on charity, then. We can *work* our way out.

And the means are available. We lack neither money nor the ability to organize and plan quickly. The difficulties are great, but they can be overcome.

Financing is probably the greatest. Heavy tax burdens and local bond obligations throttle the public work of local communities. Cities are poor; tax collections are far behind and bonding margins are small or absent. But financing is easily accomplished through the superior ability of the federal government to market bonds. Loans of far greater proportions were sold to the people during the war. A reconstruction bond issue can quickly provide all the money needed, whether it taps the huge accumulation of idle investment funds through the banks or is distributed countrywide to the people.

Nor do the problems of organizing and planning surpass the nation's powers. No one who recalls what was done in 1917 and 1918 in carrying out in a few months a vast building and equipment program and putting the country to work for national purpose will have any doubt of our present powers. Engineers are more numerous and competent, constructors have doubled their achievements. Organizational and administrative skill is ready.

A NATIONAL emergency lies ahead, but a national spirit and united purpose can carry us through by work in place of charity. Time is vital, or winter will find us unprepared. But if the will to provide it be strong enough, work can be found for all.

Reprinted from Engineering News-Record Editorial, September 3, 1931

HOLD THE ROAD IN ANY WEATHER

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Firestone GROUND-GRIP TIRES

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Change over today to Firestone Ground Grip Tires and realize these savings. When purchasing new equipment—specify Firestone Tires, Firestone Puncture Proof Tubes and Firestone Rims.

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Pavement in new central yard of Hackensack Water Co., Hackensack, N. J. W. W. Gutteridge, engineer for the company; Jos. Kinzley Co., contractor, both of Hackensack.

High-Early-Strength Pavement Ready for Heavy Traffic in 3 Days

"The buildings in the new construction and store yard of the Hackensack Water Co. were completed only three days before the time set for operating this yard. It was therefore necessary to arrange for a pavement that would bear the traffic of heavy trucks within three days," writes W. W. Gutteridge, company engineer. "Concrete had already been chosen for paving and Universal Atlas high-early-strength concrete was used to meet the time limit."

At 3 days the concrete tested over 2000 lbs. per sq. in. in compressive strength and was ready for use. From 11 to 25 days of valuable working time was thus saved the water company.

High-early-strength concrete made with Universal Atlas methods and cement is used for concrete work which calls for speed, greater strength, watertightness and durability. A booklet containing methods for obtaining it will be sent on request.

Name.....

Address.....

Universal Atlas Cement Co.
208 South La Salle St., Chicago
Without obligation, please send me booklet describing methods for securing Universal Atlas high-early-strength concrete.
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63

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Construction Methods

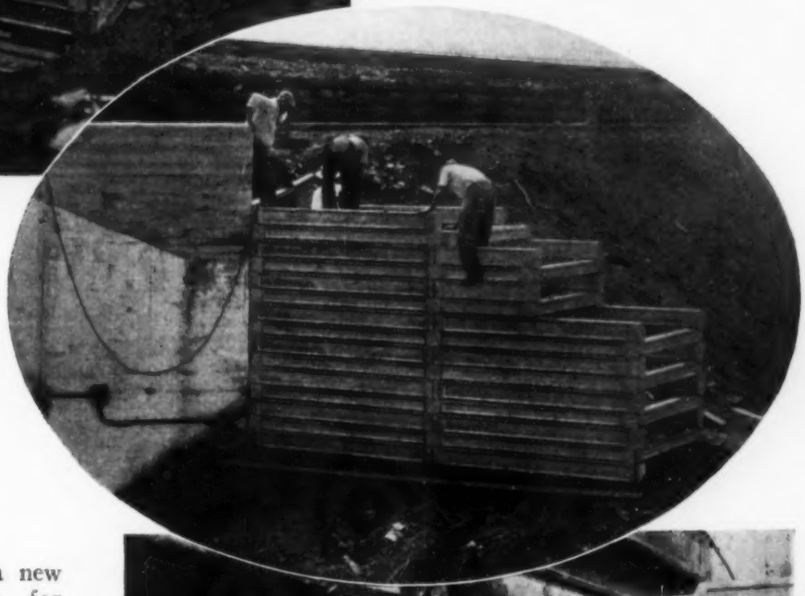
ESTABLISHED 1919—McGRAW-HILL PUBLISHING COMPANY, INC.

ROBERT K. TOMLIN. *Editor*

VOLUME 13 NEW YORK, OCTOBER, 1931 NUMBER 10

METAL CRIBBING *(left)* **is built up of standard-section headers and stretchers, interlocked by slot and lug connection. Units are light enough to be handled by one man**

CLOSED-FACE TYPE *(below)* **of retaining wall may be built as alternative to open-face type. Three lengths (4, 6 and 8 ft.) of cribbing units allow for step-offs as height of wall increases**



Retaining Walls of METAL CRIBBING

THE first installation of metal cribbing, a new product of the American Rolling Mill Co., for retaining-wall construction, was completed recently at Middletown, Ohio. As illustrated in the accompanying photographs, the cribbing is built up of standard sections in the form of a grillage consisting of 8-ft. stretchers and 6-ft. headers weighing respectively, 50 and 40 lb. each. In the top ends of each header section are a pair of slots to provide an interlock with protruding lugs on the stretchers.

The standard sections of cribbing are fabricated from heavy-gage, galvanized sheets of rust-resisting Armco ingot iron and may be built up into a retaining wall of either the open or the closed-face type. To avoid the appearance of a flat, unbroken wall surface, each cribbing unit has a recessed horizontal panel. In cross-section the headers are 6x6 in. and the stretchers 6x8 in. The cribbing is made in lengths of 4, 6 and 8 ft.

DETAIL OF CONNECTION between headers and stretchers, as seen from interior of retaining wall

This Month's "News Reel"

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ARLINGTON MEMORIAL BRIDGE, $7,000,000 multiple concrete arch structure faced with granite, crosses Potomac River at Washington, D. C., near Lincoln Memorial (in background). Hunkin-Conkey Construction Co., contractor

ST. LOUIS MART BUILDING *(left)*, 20-story concrete structure costing $5,000,000, is nearly completed. Gamble Construction Co. is the contractor

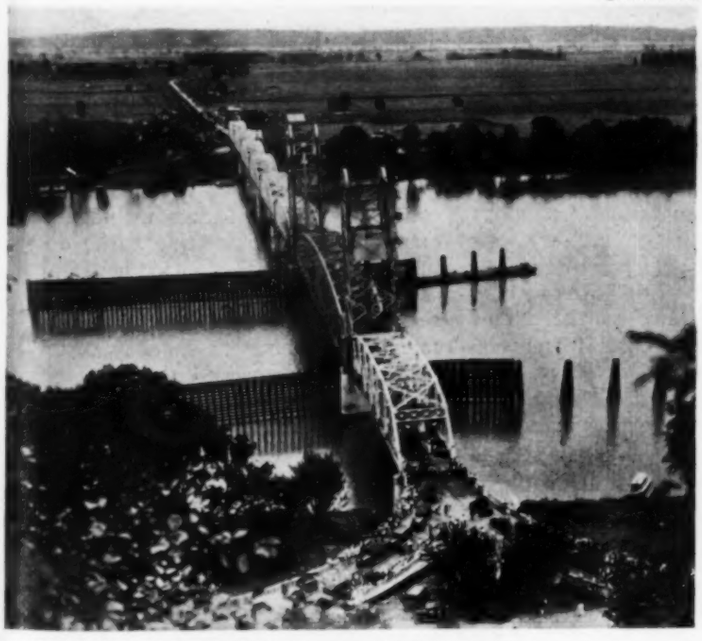
©Wide World

SAFE HARBOR DAM across Susquehanna River in Pennsylvania has been built by Arundel Corp., of Baltimore, Md., to develop 255,000 hp. Power project involved placing of 450,000 cu.yd. of concrete mixed by four 2-yd. mixers. Steel construction bridge carried standard-gage railroad tracks and four gantry cranes. Dam will make available a head of 53 ft. of water for power purposes

CLEARING AND EXCAVATING three city blocks in midtown New York for John D. Rockefeller, Jr.'s spectacular Radio City building project, to include office buildings, theatres, opera house and other structures. View shows five Lorain power shovels on substructure excavation for Clarence L. Smith, Inc. In background two similar units are at work for George J. Atwell Co.

NEW SPAN *(below)* over Illinois River. Joe Page bridge, at Hardin, Ill., comprises series of through steel trusses and vertical lift span across main river channel

©*Wide World*



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RIVER DES PERES STORM-WATER SEWER, St. Louis, nears completion as Stiers Bros. Construction Co. finishes last underground section, a 32-ft. reinforced-concrete tube which follows old channel through apartment house district. Water and restricted working space make construction difficult

IN FIRST COFFERDAM AREA three concrete spillway blocks have been carried up in seven 5-ft. lifts. Industrial railway delivers concrete in buckets for rehandling by cranes and derricks

CARPENTER DAM

and Power House Built Within Two Coffers on Ouachita River, Arkansas

By LEE G. WARREN

Superintendent of Construction, Phoenix Utility Co., Hot Springs, Ark.

THE Carpenter hydro-electric project was built for the Arkansas Power & Light Co. by the Phoenix Utility Co., on the Ouachita River, about 7 miles from Hot Springs, Ark. It is the second of a series of three hydro-electric plants comprised in the general program of the Arkansas Power & Light Co. for the development of 250,000 hp. on that river. The first, Remmel dam, was placed in operation in 1924; it is 10 miles downstream from Carpenter dam. The third, the largest of the three, will be constructed some time in the future at the Blanco Springs site, 18 miles upstream from Carpenter dam.

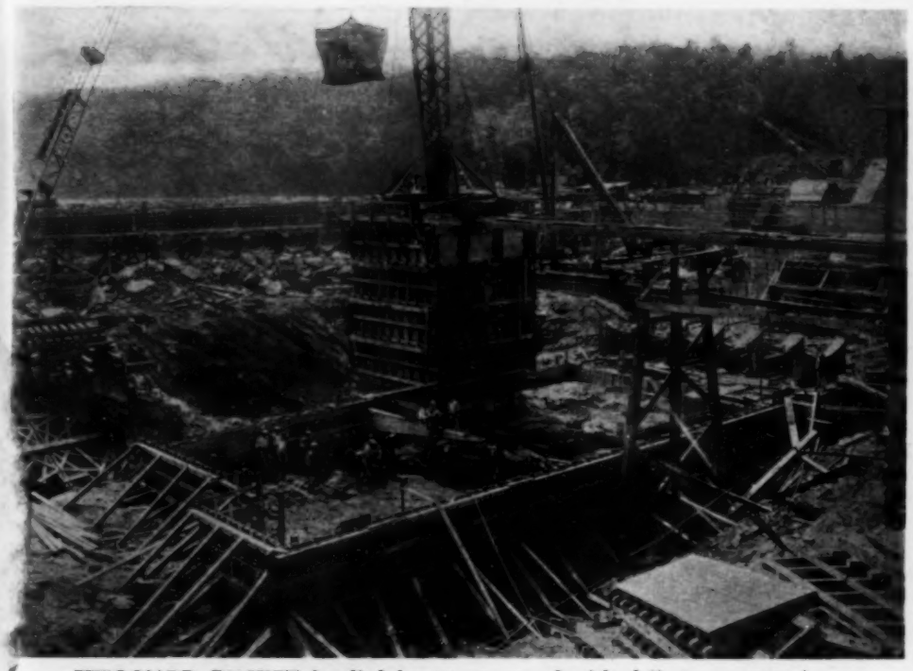
Preliminary construction operations were opened early in February, 1929, with camp construction, clearing, and building the main line railroad, 4¼ miles long, connecting the damsite with the Missouri Pacific Railroad in Hot Springs. Heavy excavation for the permanent structures was started late in April, 1929. The construction schedule called for the first generator to be placed in service July 1, 1931, and the second Aug. 15, 1931.

Measured along the upstream side, the total length of the permanent structure is 1,165 ft. The area of the lake formed by the dam is 9,000 acres at flood stage of the river, El. 400. At that elevation the shore line of the lake is about 275 miles and the lake capacity, 225,000 acre-ft. Maximum depth of water at upstream face is 113 ft.; total height of spillway section, 80 ft. from rock foundation to crest. The spillway bridge is 34 ft. high, giving maximum total height of 114 ft. Drawdown will be 26 ft.

The Carpenter hydro-electric development spillway section is of the solid gravity type. The spillway section has a straight face and straight axis. It contains 10 steel spillway gates, tainter type, each 26 ft. high and 34 ft. wide. The spillway crest is at El. 374, and the tops of the gates are at El. 400.

The power-house section is designed for two 40,000-hp. generators. The scroll cases are steel shells, each connected to a steel penstock, 22 ft. in diameter.

The main plan for manipulating the flow of the river was based upon two cofferdams: No. 1 area included the excavating and concreting to be done in the river for the power house and also for 140 ft. of the gate spillway section. No. 2 area included the remainder of the gate spillway section. The river was passed through seven stream control culverts in the completed section of the spillway, each culvert being 10x11 ft. in cross section. The entire flow of the river was conducted through these openings while No. 2 cofferdam was being constructed and while the permanent parts of spillway in No. 2 area were being installed. Steel flap gates were provided to close



TWO-YARD BUCKET handled by 20-ton guy derrick delivers concrete in headworks section. At right, note concrete cradles for 20-ft. steel penstock

the stream control culverts during the filling of the reservoir. Following their closing these culverts were filled solid with concrete.

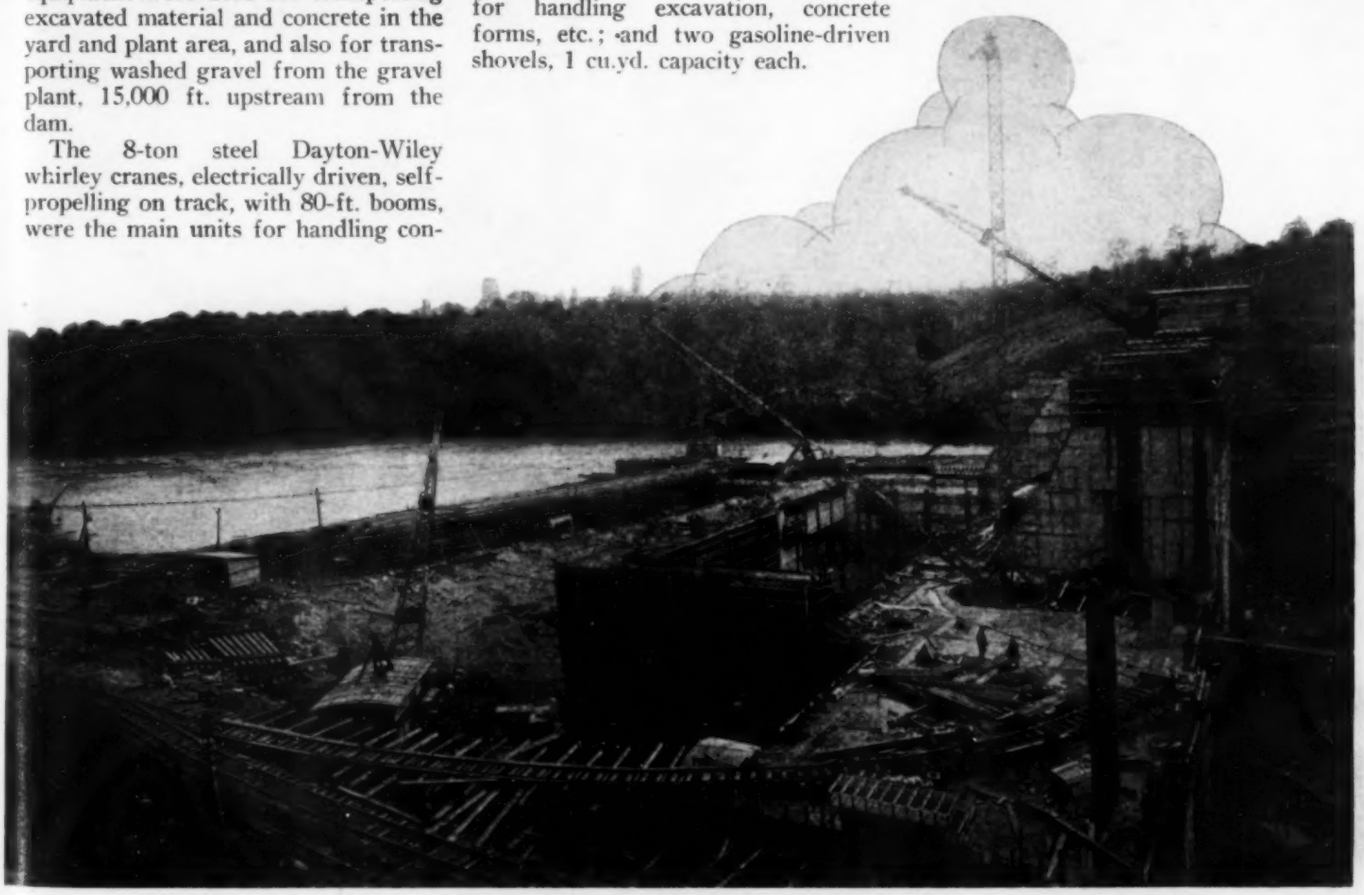
Construction Plant—Industrial track, 36 in. gage, and narrow-gage equipment were used for transporting excavated material and concrete in the yard and plant area, and also for transporting washed gravel from the gravel plant, 15,000 ft. upstream from the dam.

The 8-ton steel Dayton-Wiley whirley cranes, electrically driven, self-propelling on track, with 80-ft. booms, were the main units for handling concrete and excavated material. Additional plant included one steel guy derrick, 100-ft. boom, with a capacity of 20 tons, and also with an electric drive; two wood, stiff-leg derricks, air operated, with a capacity of 10 tons; two gasoline-driven cranes, one caterpillar for handling excavation, concrete forms, etc.; and two gasoline-driven shovels, 1 cu.yd. capacity each.

Five gasoline and four steam locomotives, together with 40 dump cars, comprised all the transportation equipment for the narrow-gage railroad and the yard and plant railroad at the job. The complete assembly of shops, including electric shop, carpenter shop, planers, and machine shop were all powered electrically. In addition, a 1-cu.yd. electrically-driven, caterpillar-type dragline gave splendid service in excavating the raw material in the gravel pit. There was also one electric crane, Ohio railroad type.

All gravel and sand for concrete were obtained by excavating in a gravel bar on the north shore of the Ouachita River, a few miles downstream from the old Arkadelphia highway bridge. Excavating the raw gravel was handled by an electric dragline, with a 1-cu.yd. bucket. This dragline loaded the raw gravel into four automobile trucks, each having a capacity of 2 yd. These trucks hauled the gravel to the washing and screening plant. There the dirt was removed and the gravel graded, by screening, into large gravel, fine gravel and sand. From the washing and screening plant, the graded material was handled by the narrow-gage railroad, 15,000 ft. long, especially constructed for this duty.

Excavation was done by two 1-yd.



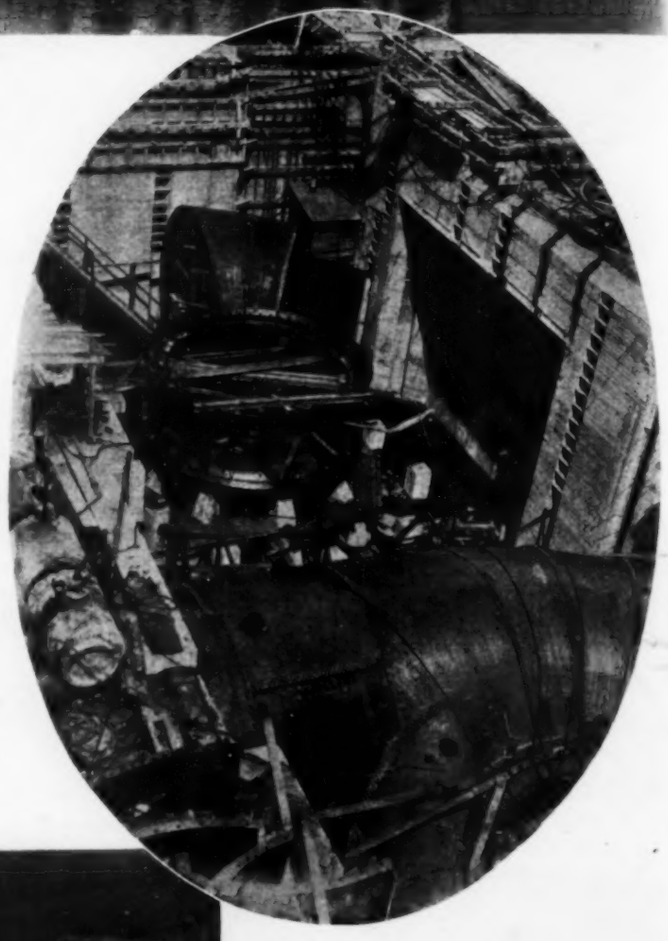
POWER-HOUSE CONSTRUCTION in progress. Side walls forming recess for scroll case are poured to final height. In lower right foreground, steel air vents lead to 22-ft. diameter penstock embedded in concrete

UPSTREAM ARM of second cofferdam. Log cribbing placed by 2-ton stiff-leg derricks and outrigger poles

gas-driven crawler-mounted shovels. Where power shovels could be used, and where the volume of excavation justified it, the electrically-driven whirley and the gas-driven cranes and the derrick handled the rock-loaded scale pans from the shovels to the narrow-gage dump cars. The scaling and light volume work necessary were done by hand labor. Compressed air drills were used for drilling the rock previous to blasting.

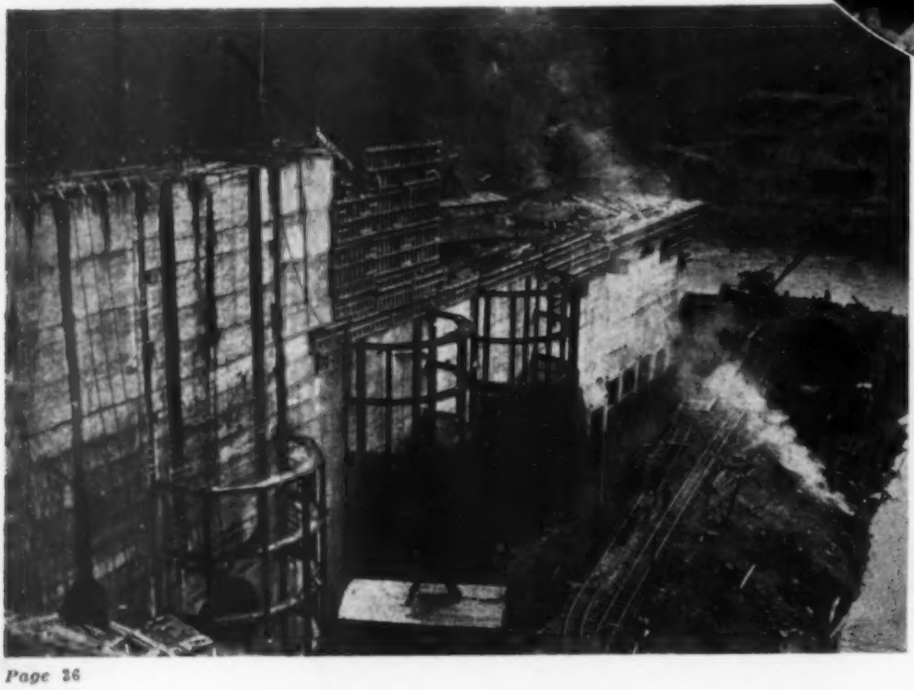
Foundation conditions were favorable. A cut-off trench 8 ft. deep and 6 ft. wide was excavated at the upstream end of the permanent concrete structures, and later filled with concrete to secure an absolute seal.

Concrete was mixed in 2-yd. Smith electrically-driven mixers, located in the central mixing plant. These dumped directly into a chute, which discharged into 2-cu.yd. steel buckets, resting upon narrow-gage flat cars on railroad tracks



SCROLL CASE ERECTION *(right).* Speed ring has been set and two and one-half rings of scroll case placed

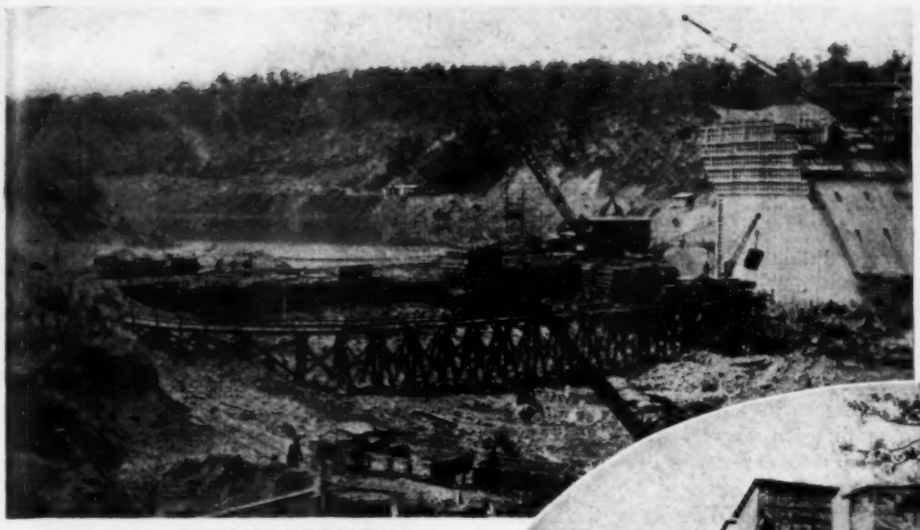
UPSTREAM FACE OF DAM *(below)* showing penstock gates, trash screens and trash screen racks of structural steel



adjacent to this plant. The buckets were then hauled on the yard and plant railway to the whirley, or crane, or derrick which lifted them directly to the forms where they were dumped.

All concrete forms were of wood and were fabricated on the job. The draft tubes and the panel forms for the spillway were fabricated and assembled on a large form-building platform adjacent to the carpenter shop. The panel forms wereu sed many times during the course of the work.

The Arkansas Power & Light Co. supplied the main project and also the gravel-washing and screening plant with electric power. For night work all excavating and concreting areas were well lighted with electric spots



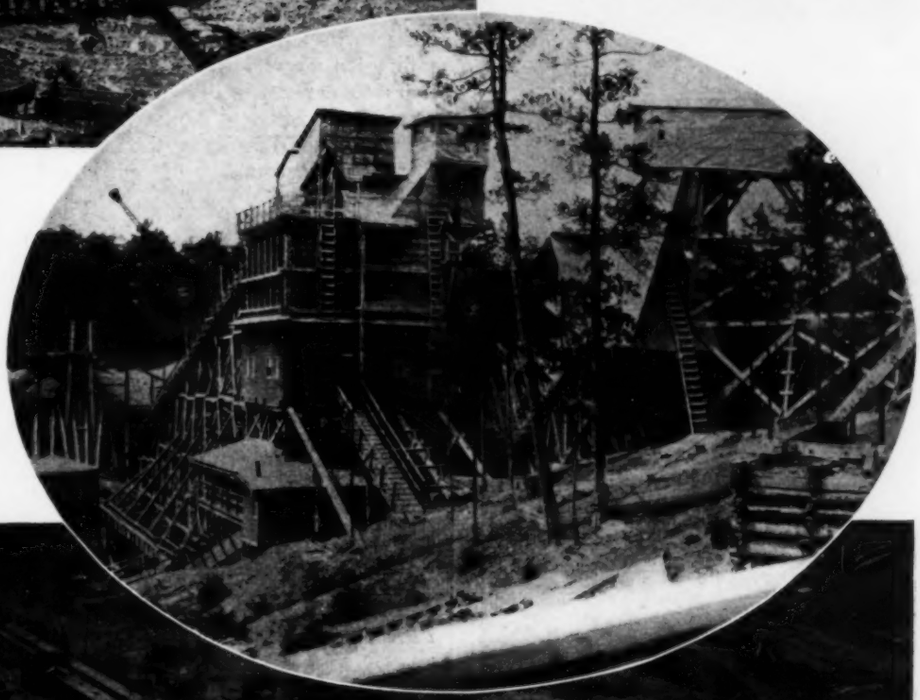
SPILLWAY SECTION EXCAVATION started within second cofferdam. Spoil dump located upstream from dam on south bank of river

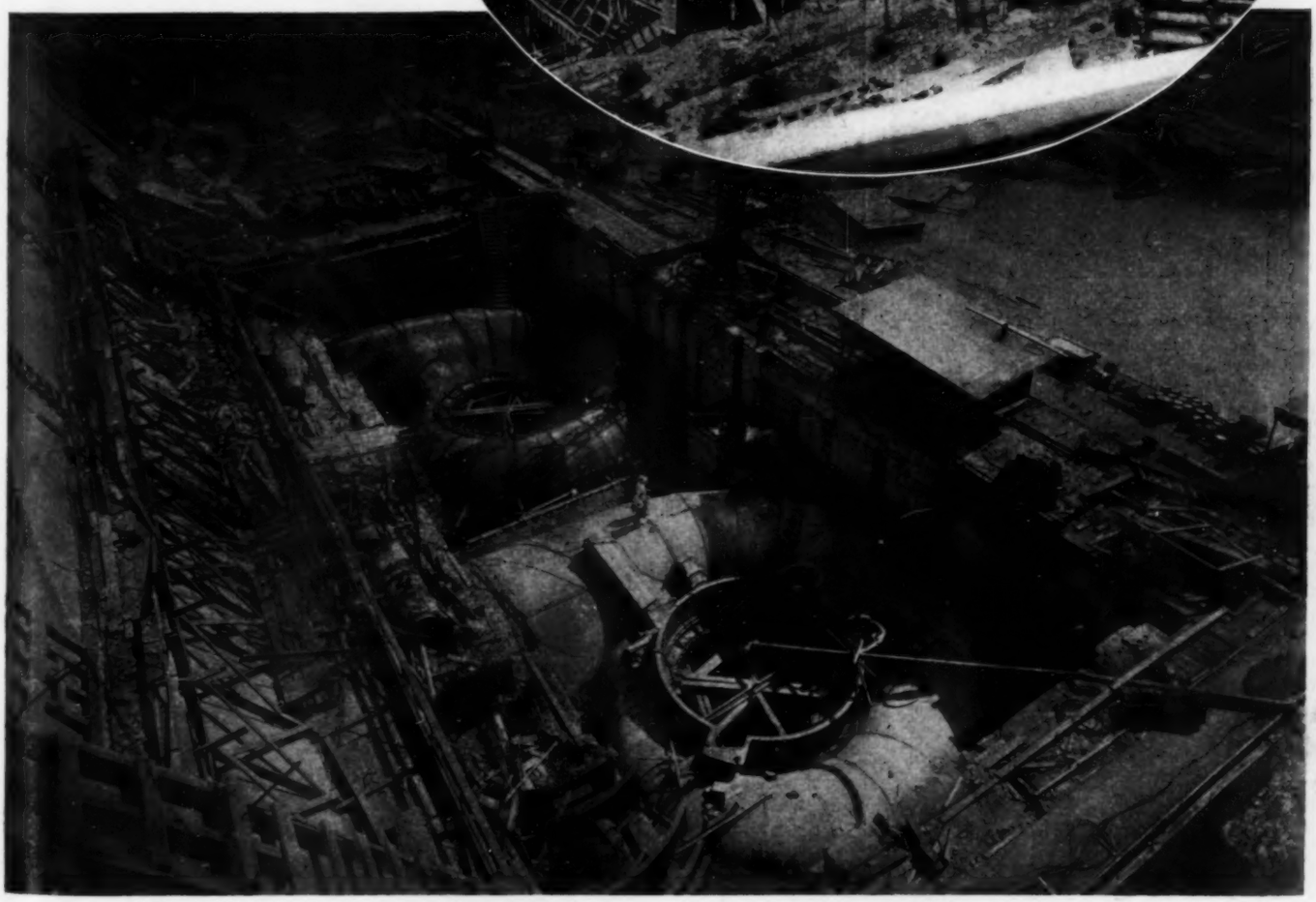
and flashlights placed on poles in the working site and vicinity.

Besides providing the abundance of electrical energy essential to further industrial development, other benefits from the construction of the Carpenter dam will be to lessen floods on the Ouachita River, contribute toward an even flow of the river and aid navigation.

C. S. Lynch is chief engineer of the Arkansas Power & Light Co. and the Carpenter operation came under his direction. K. V. Jones was resident engineer and the writer superintendent of construction.

MIXER PLANT *(below)* has elevated aggregate bins feeding two 2-yd. mixers. Bulk cement bin at right





COMPLETED SCROLL CASE, in foreground, is ready to be encased in concrete. Top of wall around scroll case recess is at elevation of operating floor of power house

SEWER PIPE

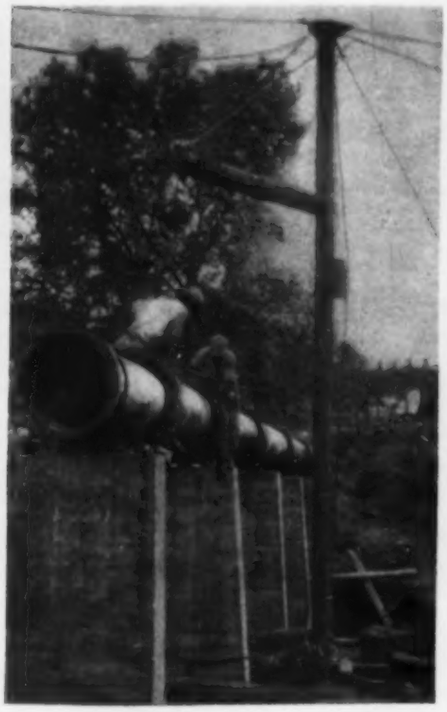
Laid Above and Below Ground

By W. R. BLAKELY

Engineer & Superintendent
Christensen Bros. Company,
Urbana, Ill.

THE accompanying photographs illustrate various details of method and equipment employed in constructing a $200,000 trunk sewer at New Albany, Ind. Cast-iron and vitrified clay pipe, in diameter from 12 to 36 in., were used on the project. Variations in topography made it necessary in some places to lay the pipe in trenches extending to depths of 33 ft. and in others to carry the line 20 ft. above ground on concrete piers. Construction was made difficult by the presence of swampy ground and quicksand. Tunneling was resorted to on some sections of the work.

In laying pipe on concrete piers, the gin pole method, used at first, was superseded by an elevated plank runway along which pipe lengths were rolled to place. The contractor was Christensen Bros. Co., of Urbana, Ill.



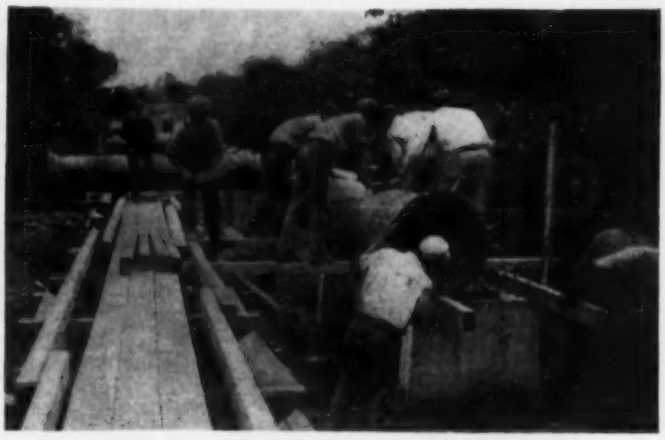
STEEL TRUSS on concrete piers carries 36-in. cast-iron pipe across creek. Pipe sections lowered from old highway bridge alongside. GIN POLE *(right)*, used at first to handle 24-in. cast-iron pipe lengths on piers, was abadoned in favor of plank runway

PLANK RUNWAY along concrete piers proved to be a more effective means of delivering 24-in. cast-iron pipe sections to place. Progress, 240 lin.ft. daily as against 48 lin.ft. with gin pole

TRESTLE STRUCTURE supports runway over which carts deliver concrete for piers. Runway also used for rolling pipe to place

ROLLING PIPE along elevated plank runway proved to be a far quicker method than handling sections with a gin pole

TURNING one of the lengths of 24-in. cast-iron pipe on runway before seating it on its concrete pier supports



ROLLED TO PLACE. Pipe section shown in preceding illustration has been turned through an angle of 90 deg. and is approaching its final seat on the concrete piers

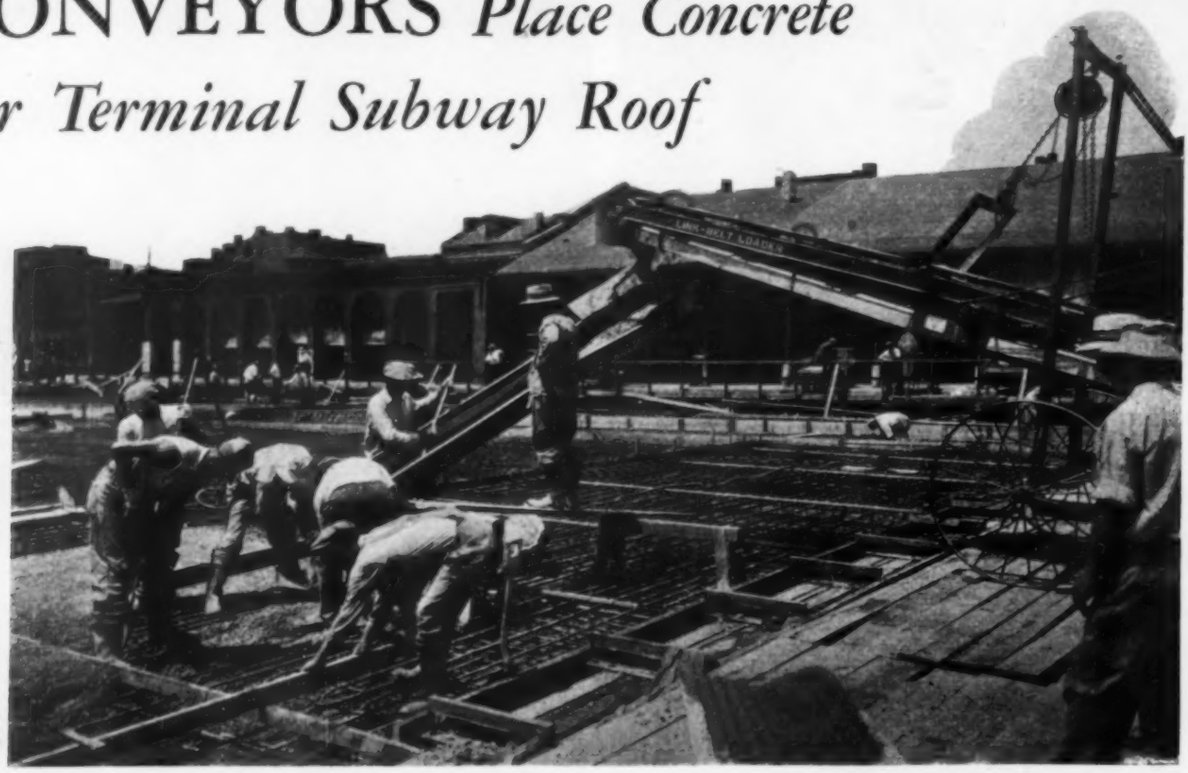
TUNNELING was resorted to for a section of 21-in. triple strength vitrified clay pipe at a depth of 33 ft. below ground surface. Well points in tunnel dried up 3½ ft. of quicksand

OPEN EXCAVATION to 31 ft. depth was done with crane bucket. Steel sheet piling and well points were employed on this section of the contract

CIRCLE-SWING DERRICKS *(left)* on which air hoists were mounted furnished the lifting and lowering power for lengths of 21-in. triple strength vitrified pipe used in tunnel 33 ft. underground

HOME-MADE BOOM EXTENSION *(above)* proved efficient on light work done by one of the contractors' crawler-mounted cranes

CONVEYORS *Place Concrete for Terminal Subway Roof*



BY G. L. TARLTON
Contractor, St. Louis, Mo.

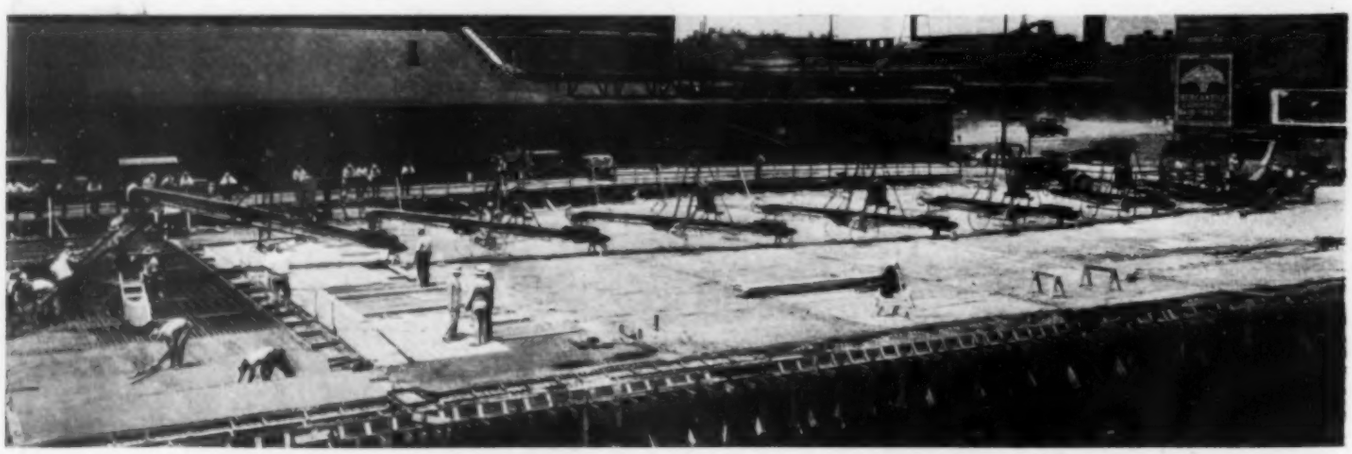
ON the construction of the $15,000,000 Illinois terminal and warehouse project in St. Louis, Mo., portable belt conveyors delivered 12,000 cu.yd. of concrete for the roof of a subway forming a street 100 ft. wide and 2,200 ft. long. The thickness of the slab is 10 in. and the concrete ran about 5½ yd. per linear foot.

The concrete was a 1:2:4 mixture, 4- to 5-in. slump, delivered from a central mixing plant in "bath tub" body trucks containing 2.1 yd. each. Pouring schedule called for a load every 3 min. The conveyors were never overloaded; in fact, the belt speed had been slowed down to suit the loading. To accommodate the distributing and tamping about 1½ to 2 min. was taken to discharge concrete on the first conveyor.

The plan of pouring was to advance in 20-ft. sections and a total of eight Link-Belt portable belt conveyors was used at times, which gave a conveying line of 200 ft. Conveyors were on 26-ft. centers with 24 in. wide belts and were standardized units, except that a V-shaped rubber scraper was applied to the return run to keep the belt clean. The belt feed was 150 ft. per minute. The conveyors were not called upon to handle more than 1 to 1½ yd. of concrete per minute, at angles up to the final conveyor set at 20 deg.

Labor to distribute the concrete consisted of 11 laborers, 2 hoisting engineers and 1 oiler. To accommodate the 100-ft. width of pour the conveyor line was moved about five times for each 20-ft. section of floor length. Less than a minute was taken to move and line up a conveyor. To aid when resetting and lining up, each conveyor was provided with a wide hopper on the foot end to place the concrete properly on the belt. A complete 20-ft. section, 100 ft. wide, was poured in about 4½ hours. As each of the conveyors was powered by its own 8-hp. Le Roi engine, complete flexibility was maintained at all times.

For G. L. Tarlton, the contractor, J. C. Hail is general manager, and Frank Munro, superintendent.



LINE OF EIGHT PORTABLE CONVEYORS places concrete in 20-ft. sections across width of 100 ft.

Contractor Sets 19-Ton Girders With 6½-Ton Crane

E. H. Amlin Improvises Ingenious Rig to Place 80-Ft. Steel Members for Bridge in Ohio

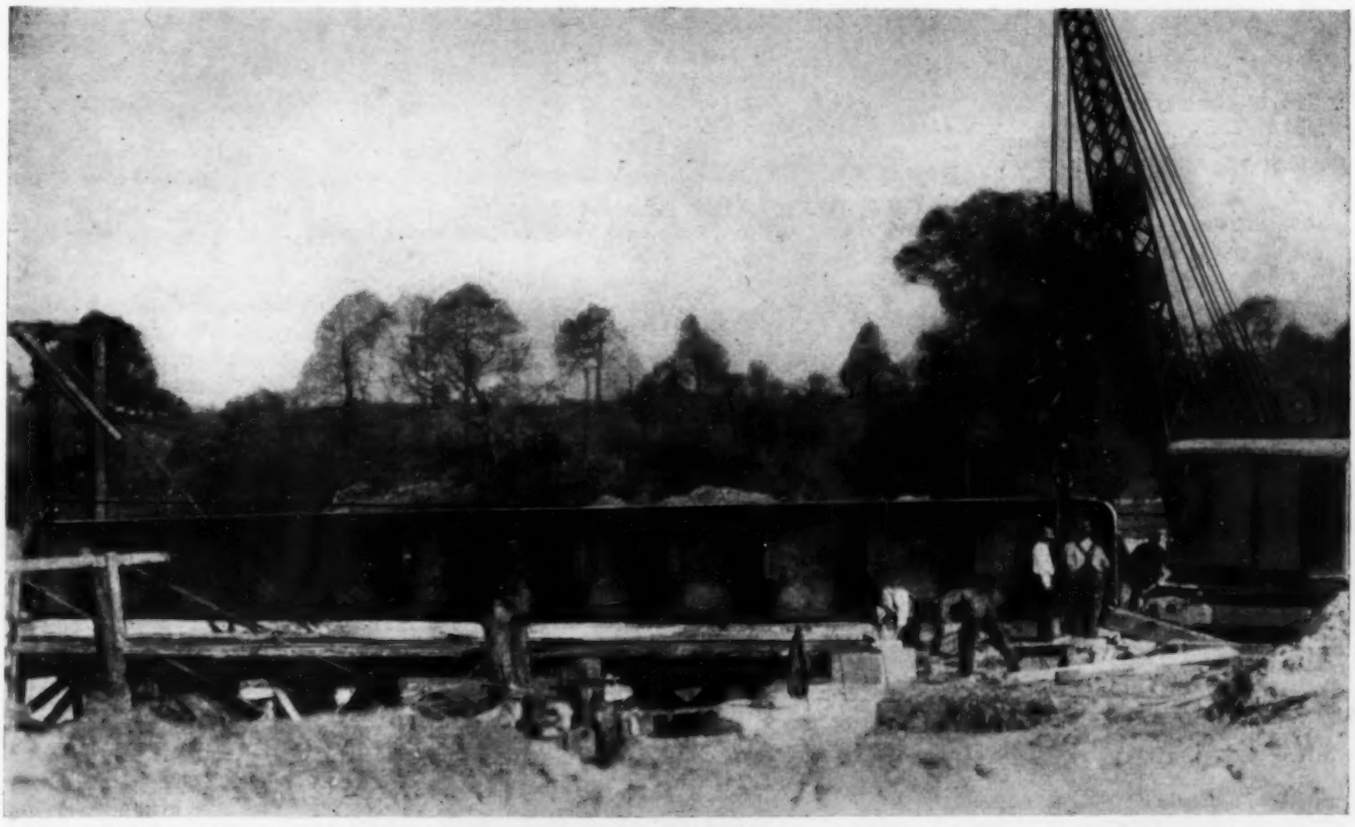
HOW to set two 19-ton bridge girders 80 ft. long using only his ½-yd. Byers crane with 35-ft. boom was the problem that confronted E. H. Amlin, contractor, of Barberton, Ohio. If possible, Amlin wanted to avoid the expense and delay of renting a 20-ton crane. Finally he conceived an arrangement whereby his own crane, rated to lift only 6½ tons, was able successfully to distribute and set the two heavy girders.

Here's how the operation was handled: When each girder was delivered to the job on trailers it was first blocked up to let the trailers run out from under it. Then the Byers crane lifted the end of one girder nearest the bridge and rollers were set under it. Next, the crane moved to the other end of the girder (away from the bridge), lifted it, and with a push pole shoved it across the river over temporary falsework of I-beams and timbers to the opposite pier.

The problem of setting the girder required the building of a 30-ft. gallows frame on the far pier from which was rigged four parts of line to end of the girder beneath it. One end of this cable was run back across the river directly to the crane's closing drum, much in the same fashion that a dragline cable is reeved. The crane's holding drum held cable that went over the top of the boom and down through three parts of line to the near end of the girder.

Finally, both ends of the girder were placed over the rocker bearings at the same time when the crane operator stepped into the cab and operated both drums simultaneously. The same cable reeving was used to set the second piece and the total time consumed in distributing and placing these girders did not exceed two ordinary working days.

The saving approximated 48 hours of time, waiting for a heavy crane to be trailed 20 miles to the job, and about $250 in money.



GALLOWS FRAME rigged with four parts of line enables light crane with 35-ft. boom to set 19-ton bridge girder. Crane uses two cables, one from each drum, to lift both ends of girder simultaneously. Device saved cost of renting heavy crane

MOTOR TRUCKS ARE

in Making Earth Fills for

USING motorized equipment almost exclusively on all except the lightest jobs, highway contractors on the extensive road-building program in Tennessee are speeding up their work while cutting earth-moving costs to pre-war levels. In fact, except for a few flea-bitten outfits here and there, mule and horse power are of the past.

Typical of the better handled motorized jobs is a 12.7 miles of grading in western Tennessee done by the Gregory-Chandler Co., Inc., of Virgilina, Va., as illustrated by the accompanying photographs. This job involves about 345,000 cu.yd. of material, practically all of which was classed as earth. Cuts ran from 3 to 15 ft. deep, with the fills also shallow.

The contractor used two 1¼-yd. gas shovels, serving each with from eight to a dozen 3-yd. dump trucks, depending on the length of haul and on local working conditions. When loaded, the trucks backed away to where the fill was being made. It was not uncommon for the loaded trucks to be run backwards as much as 750 ft. Arriving at the fill the drivers simply dumped their truck loads in a pile, shifted into high and returned to the shovel at speed.

For this scheme of truck operation several advantages are claimed. In the first place, all turning of the truck is eliminated. Secondly, the loaded truck travels in the gear that gives the most power. Third, the load may be dumped at the spot desired without any manipulation of the truck as it arrives. The drivers soon learn to drive in reverse as well as they do when going forward.

The material as delivered in the fill in piles by the trucks is leveled off with a bulldozer on a crawler tractor. This means that the trucks may dump their loads within relatively wide limits, so long as they are within the grade stakes and in an area over which the bulldozer has not worked. As a matter of fact, the loads are dumped accurately, one next to the other. The trucks discharge and get away almost instantly. Where sticky soil is found, a man at the dump with a long-handled rake clears the truck bed with little or no delay.

E. M. TURNER, assistant state highway engineer in charge of construction

TRUCK READY TO BACK AWAY from 1¼-yd. gasoline shovel, with second truck ready to move up for loading

EARTH DUMPED IN PILES by trucks. Sticky material is removed by long-handled rakes

RUN BACKWARDS

Highways in Tennessee

Dumping is done and the bulldozer is handled so as to get the fills made in layers about 6 to 12 in. deep. The bulldozer blade can be adjusted to get any depth of compaction desired down to as little as 2 to 3 in. After the trucks have dumped on a stretch long enough so the tractor can get a good run without turning too often, the bulldozer is worked back and forth lengthwise of the fill across the new material until the latter is evenly spread and well compacted. In doing this the tractor produces at least as good compaction as is possible with team outfits, or any other method of handling dirt.

Truck and shovel outfits are used to advantage on cuts as shallow as 5 ft. Regardless of the depth of cut, the scheme that shows the best results is to have more than enough trucks to keep the shovel busy. Experience proves that it is cheaper to have trucks waiting than it is to hold the shovel idle for haulage equipment to arrive.

With the 1¼-yd. shovels commonly in use in Tennessee on state highway work, 3-ton heavy-duty trucks of the best makes obtainable have been found the most satisfactory. Pneumatic tires are used exclusively, with balloon types common. Almost without exception, dual rear wheels are employed.

Single shovel and truck outfits of the type illustrated are moving from 18,000 to 24,000 yd. a month of earth excavation on the average run of jobs. With the exception of one or two men at the dump when the material is sticky, not a laborer is used on the ground. Nor is there a single horse or mule. Gasoline and fuel oil, with ample modern equipment of the latest types, are permitting contractors to get costs down to levels that would have appeared out of the question a year or two ago.

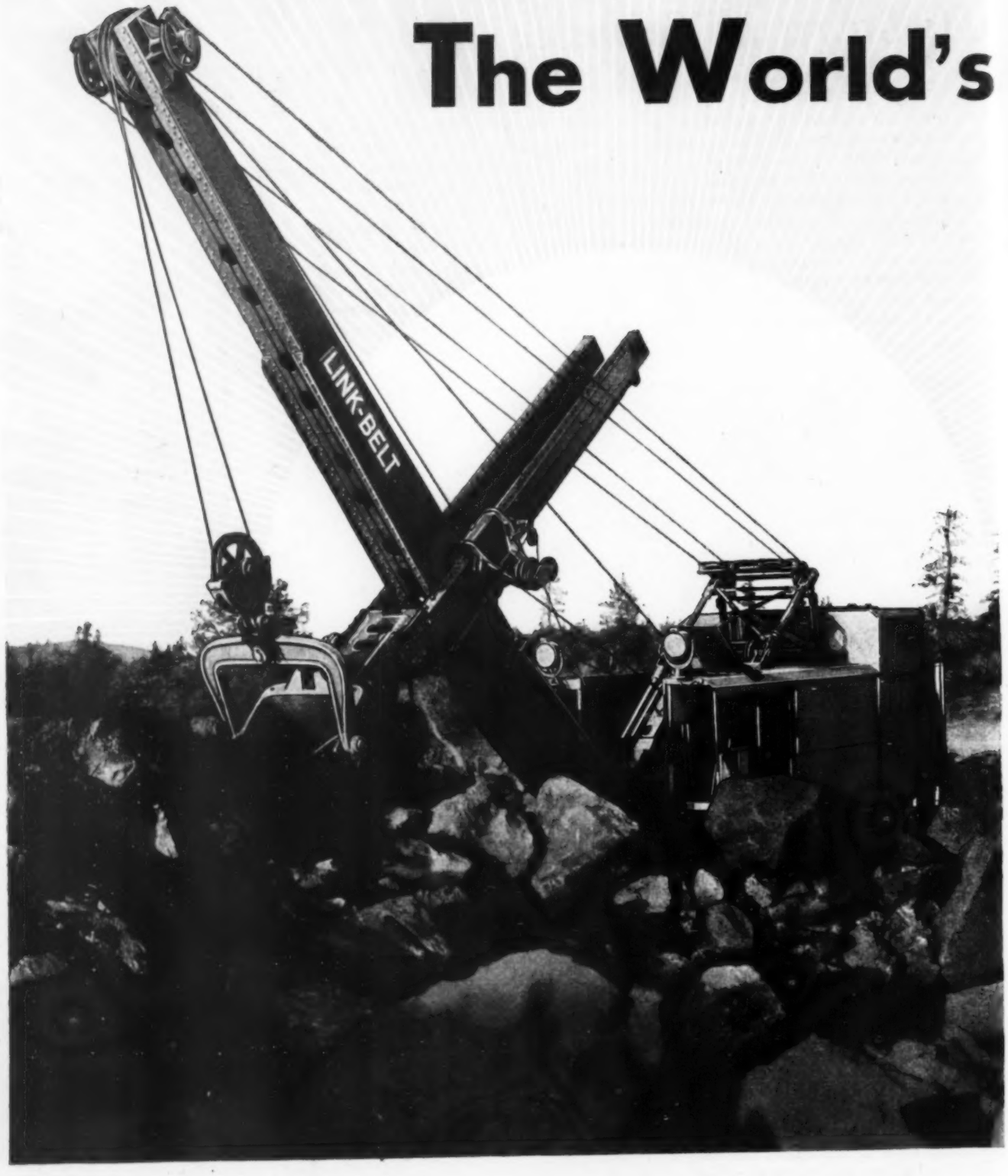
R. H. Baker is commissioner of the Tennessee Department of Highways and Public Works, T. C. McEwen is state highway engineer and E. M. Turner is assistant state highway engineer in charge of construction. Charles C. Poole was in charge for the contractor on the project illustrated.

BULLDOZER on tractor spreads dumped earth in layers. At right loaded truck has backed up from shovel and is dumping

CHARLES G. POOLE, manager of Gregory-Chandler Co., contractor, confers with R. L. SEATE, foreman

ELEVATING GRADER, operated by large tractor, is served by 3-yd. dump wagons, hauled by light tractors

The World's



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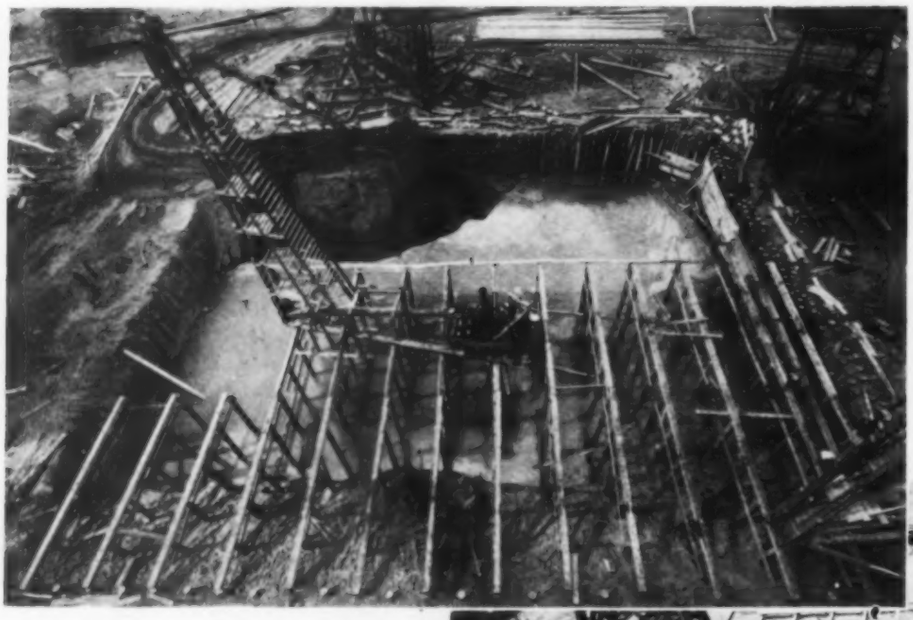
SHOVEL - CRANE - DRAGLINE

Step-by-Step
Building a Million Bushel Concrete

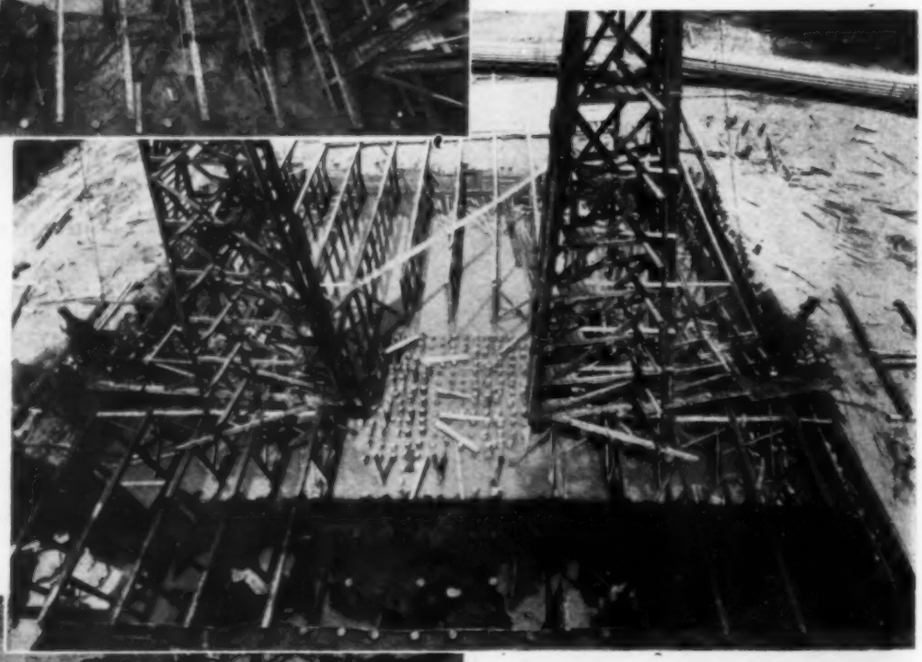


ON a rush job last year to complete a 1,000,000-bushel grain storage elevator before the arrival of the new crop Albertson & Cornell Bros., Inc., Tacoma, Wash., worked crews for 24 hours a day during the entire construction period. The work was done for the Commission of Public Docks of Portland, Ore., under the direction of A. D. Merrill, chief engineer. The first bearing piling was driven on June 8 and the first grain was stored in the structure Aug. 31.

During this brief construction period, 2,300 bearing piles, from 100 to 105 ft. long, were driven, 12,640 cu.yd. of

1 **FALSEWORK PILES** are driven preparatory to driving 2,300 bearing piles, each 105 ft. long and spaced on 3-ft. centers. Note that staging is almost finished while hole has not yet been completely excavated.

June 7



2 **BEARING PILE DRIVING** ***(above)*** **is well under way. First bearing pile was driven June 8 under sub-contract with Baker Construction Co., of Portland, Ore. Two pile drivers are equipped with 108-ft. leads and 7,500-lb. Vulcan hammers. Pile driving rigs worked 24 hours a day.**

June 19

3 **LAST BEARING PILE** ***(left)*** **is driven July 26, marking completion of driving 2,300 piles, each 105 ft. long, by two rigs in 48 days. Site is 153x138 ft.**

July 26

Field Methods

Grain Elevator in 12 Weeks

transit-mixed concrete was placed in 27 days and 7,000 cu.yd. of this total volume of concrete was poured in the walls of the circular bins in slightly less than one week's time. There are a total of 72 circular grain storage bins each 14 ft. 4½ in. inside diameter.

Working for a $1,000 a day bonus, the contractor made a particular effort to synchronize the various operations to eliminate loss of time between the various steps in the work. It is to be noted particularly in each of the pictures that the steps followed each other so closely that two and sometimes three were under way at the same time.

4 **CONCRETE MAT** ***(above)***, **2 ft. thick, capping the piles is half poured two days after picture No. 3 was taken. All concrete was transit-mixed. In lower left-hand corner steel for forms is being assembled.**

July 28

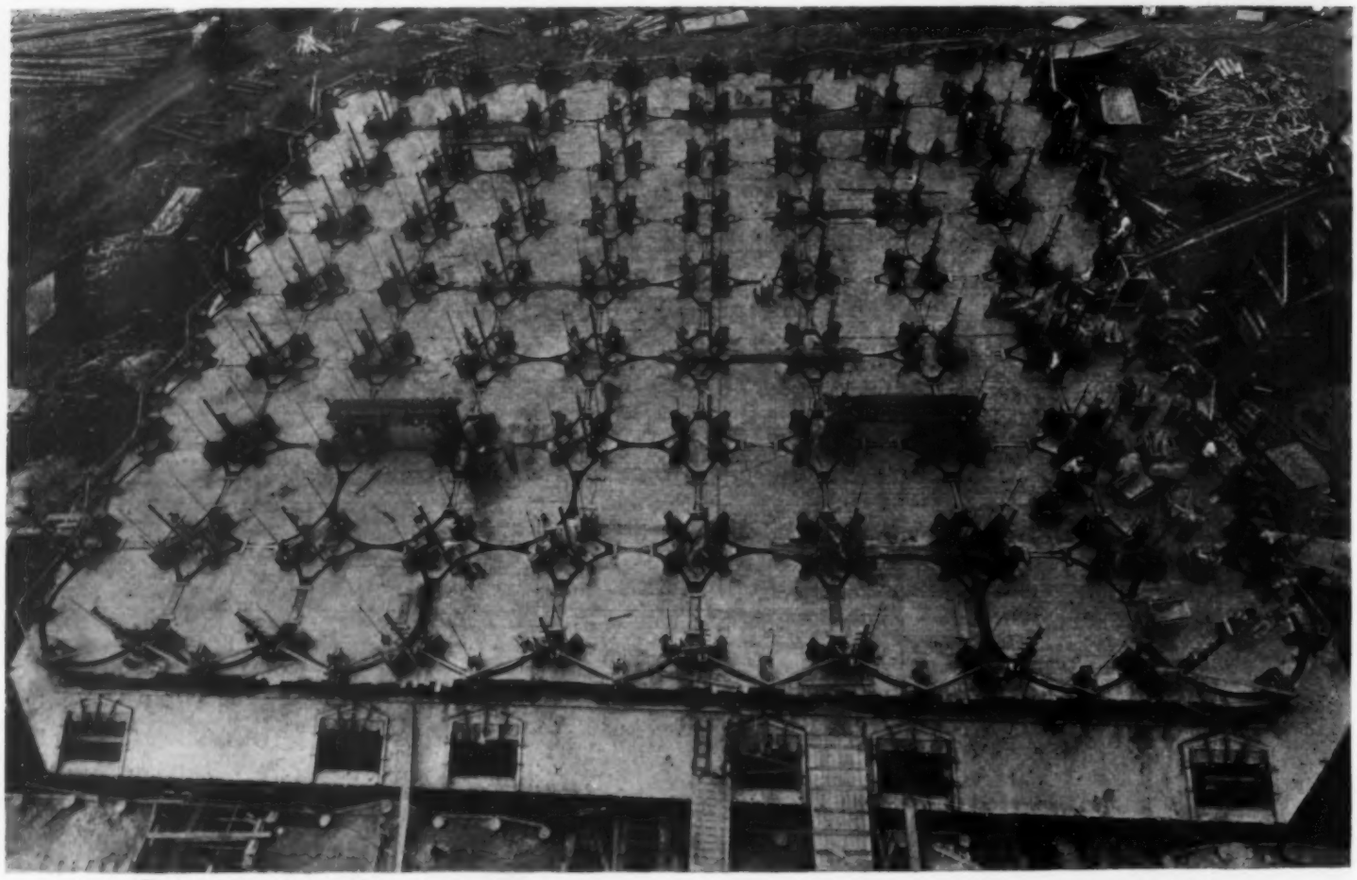
Continued on next page

5 **FORMS IN PLACE** ***(above)*** **for concrete piers to support circular grain storage bins, leaving headroom for discharge of grain. This photograph taken 3 days after No. 4. Work was carried on continuously in 3 shifts per day. Pier walls are 15 in. thick and 17 ft. high. Piers are hollow columns, measuring 7 ft. 6 in. x 9 ft. There are a total of 79 interior piers.**

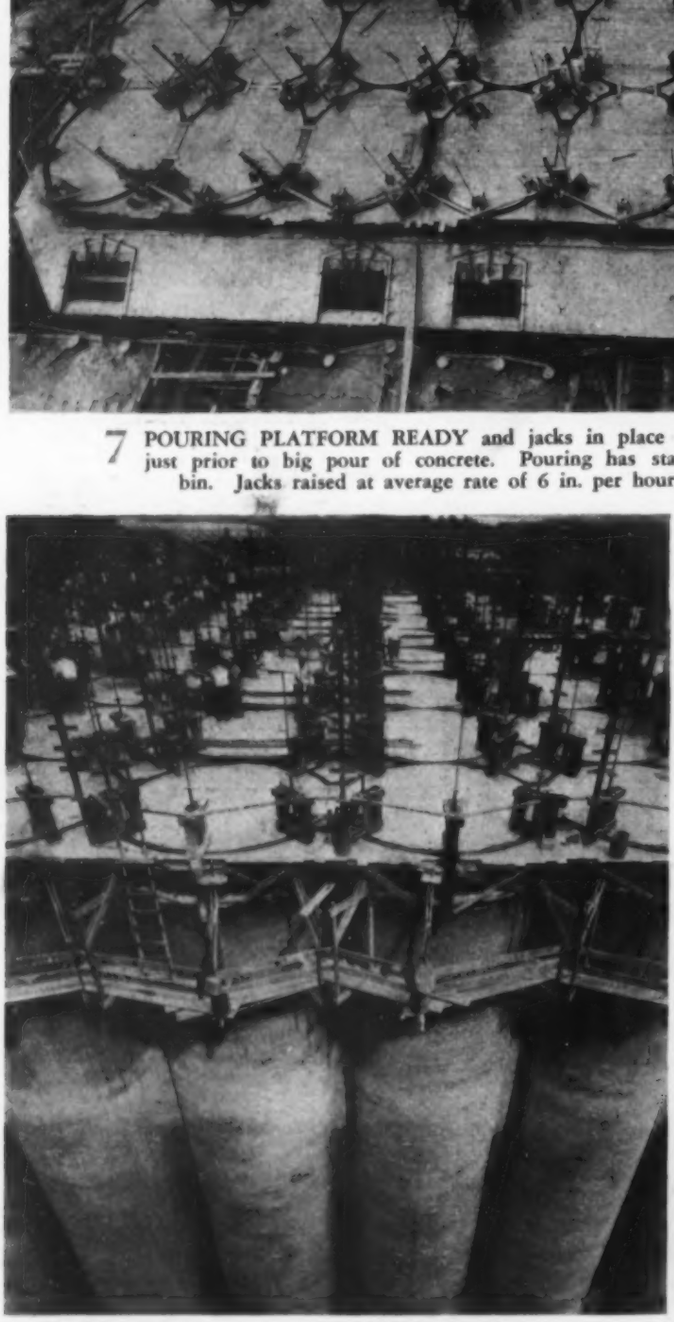
July 31

6 **SLIP FORMS** ***(right)*** **are in place for receiving concrete for the circular bins, each 79 ft. high and 14 ft. 4½ in. inside diameter. Bin walls are from 7½ to 8½ in. thick. Total number of bins, 72. Wooden slip forms 44 in. deep, sprayed with oil, hold concrete for walls.**

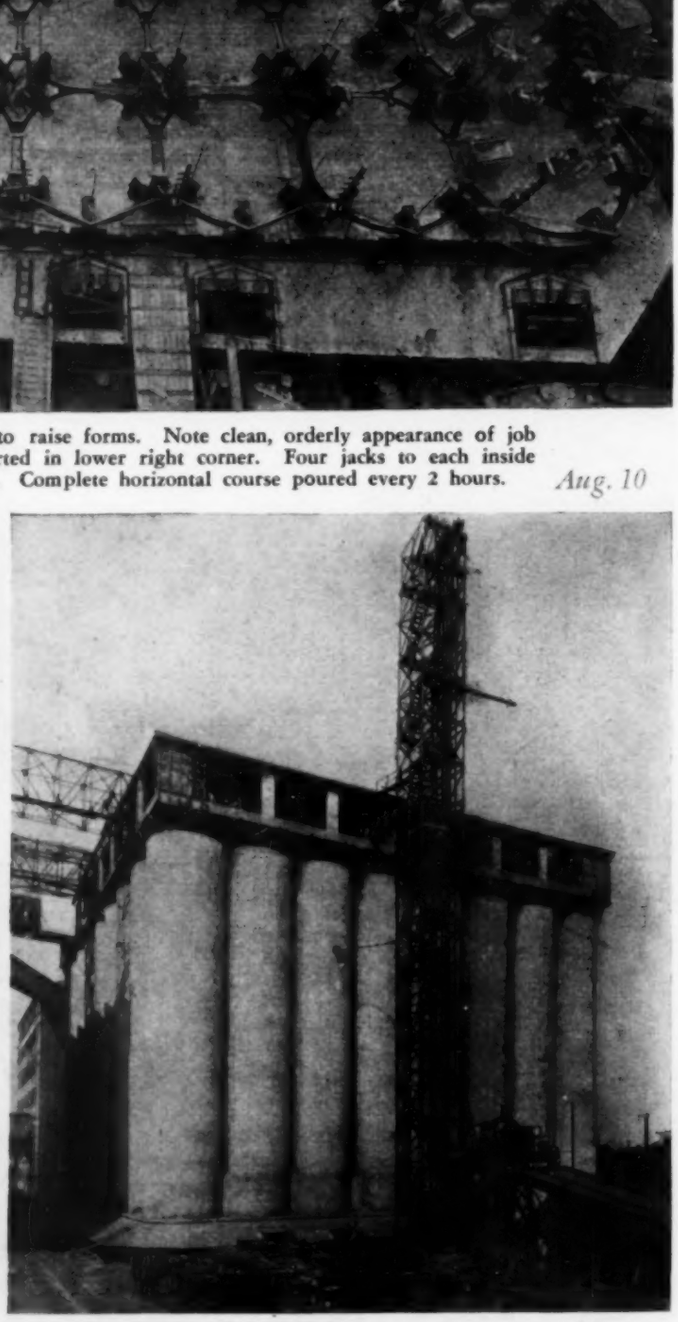
Aug. 7



7 **POURING PLATFORM READY** and jacks in place to raise forms. Note clean, orderly appearance of job just prior to big pour of concrete. Pouring has started in lower right corner. Four jacks to each inside bin. Jacks raised at average rate of 6 in. per hour. Complete horizontal course poured every 2 hours. *Aug. 10*



8 **WALLS HAVE RISEN** to finished height of 79 ft. one week after photograph No. 7 was taken. Total concrete poured in walls, 7,000 cu.yd. Overhead lighting facilitated night work. *Aug. 16*



9 **STRUCTURE COMPLETED,** except for finishing touches, so that wheat could be delivered into storage bins 84 days after first bearing pile in foundation was driven. Total concrete, 12,640 cu.yd. *Aug. 28*

Light Trucks, With Trailers, Haul
THREE-BATCH LOADS

Hilding Construction Company Operates Own Fleet of Twelve Cars on Michigan Concrete Highway

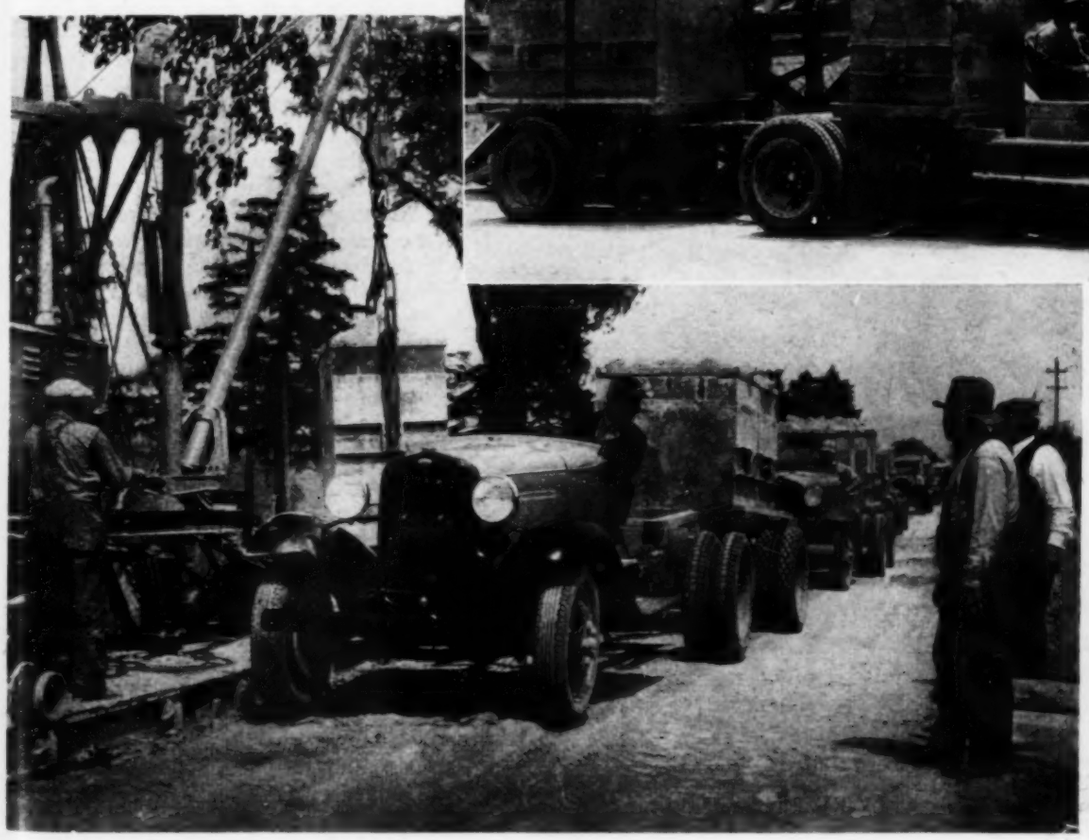
FOR hauling dry batches of aggregate and cement from a central proportioning plant to a concrete paving mixer on a 9-mile state highway construction project between Adrian and Hudson, Mich., the Hilding Construction Co., of Saginaw, is operating a fleet of 12 Ford trucks, each equipped to carry three 1-yd. batch-boxes, one batch on a special platform body on the truck chassis, and the other two batches on a two-wheel trailer. Both trucks and trailers are mounted on pneumatic tires. The two-wheel trailers are designed for quick coupling or uncoupling from the truck and are equipped with springs. Around the platforms on both trucks and trailers are plank guards to prevent the batch boxes from being jolted off in transit over rough roadways. Interchangeable with the flat platform bodies for aggregate haulage are 1-yd. end dump bodies which the contractor purchased when he bought his trucks.

At the beginning of the work the length of haul from the loading bins was 5 miles. Working a 10-hour day, the trucks made from 12 to 15 trips each. Daily progress in concreting the 20-ft. wide pavement averaged about 850 lin.ft.

From an overhead steel bin and batcher alongside a railroad siding aggregates were discharged by gravity into the three batch boxes constituting the load for each truck. A through driveway under the bin eliminated backing up and other time consuming operations of the trucks at the yard. Cement, in bags, was loaded on top of the batches from a long elevated wood platform. At the mixer, a 27-E Koehring unit, the trucks pulled up alongside and the batch boxes were picked off by a boom hoist on the mixer and dumped directly into the mixer skip.

L. S. HILDING, president, Hilding Construction Co., of Saginaw, Mich., who operated own fleet of 12 light trucks for hauling batched aggregates and cement

TWO-BATCH TRAILER *(above)*, on pneumatic tires, was coupled to truck chassis equipped with flat platform body carrying third batch



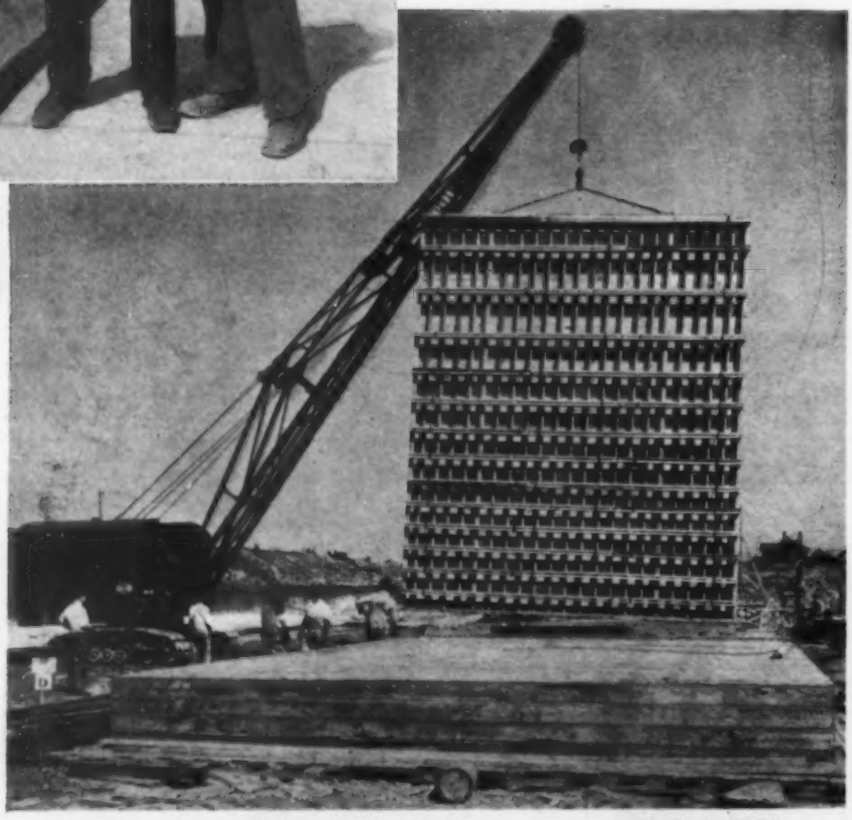
LIGHT TRUCKS *(left)* each delivered three batch boxes to boom hoist on paving mixer. Maximum haul was 5 miles

WALL CONSTRUCTION proceeds in sequence of operations on group of separated sections.

FLEXIBLE PLANT AND

Effect Economies on

SIMPLICITY and similarity in the structural features of a 30,000,000-gal. reinforced-concrete covered distributing reservoir which the Mahoning Valley Sanitary District is completing at Youngstown, Ohio, enabled E. H. Latham & Co., of Columbus, contractors, to employ economical form systems for the walls, colums and roof. A central job batching plant and mobile mixing and placing units added to the efficiency and flexibility of concreting operations. The work was effectively organized by R. E. Weidman, superintendent, to obtain steady progress with a minimum of costly delays caused by moving plant or changing to new forms of construction.



WOOD PANEL FORM for wall is handled by crawler crane. M. C. KINDER *(left, above)*, division engineer, Mahoning Valley Sanitary District, and R. E. WEIDMAN, superintendent, E. H. Latham & Co.

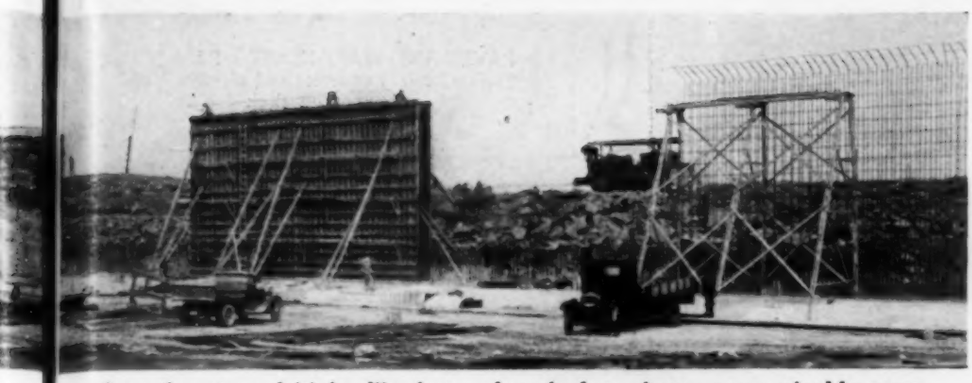
Design—The distributing reservoir is of flat slab roof construction, with drop panels over the flared capitals of the columns. Walls rest on cantilever footings and are backfilled on the outside. Horizontal dimensions are 476 x316 ft. between inside faces of the walls.

The entire foundation under footings and floor of the reservoir is sandstone and shale rock. To save rock excavation, the floor was divided into three irregular areas at different elevations, with sloping floor bays between the various areas. Because of the irregularity in depth of excavation, height of the roof along the walls varies from 19.75 ft. to 30.25 ft. above the footing, which is 4 ft. deep under the wall. The top of the footing slopes 1 ft. 9 in. (vertical measurement) to the floor level at the adjacent row of columns. A 6-in. slab of plain concrete forms the floor.

Three of the walls are battered on the outside ½ in. in 12 in. to a minimum thickness of 21 in. at the top. The fourth side is closed by a dividing wall which provides for future addition to the reservoir. This wall has constant thickness of 2 ft. 9 in. from the footing to the keyed joint with the roof.

Columns are 26 in. in diameter and are spaced 20 ft. apart, c. to c. Those columns resting on the cantilever footing of the outer floor bay are centered 18 ft. from the inside face of the wall. Footings of other columns rest on rock generally at the same elevation as the floor. The footings are 5 ft. square and are varied in height to equalize the lengths of column shafts in any of the three floor areas. These lengths, between footing and capital, are 17 ft. 6 in. for 28 columns, 22 ft. 6 in. for 121 columns, and 27 ft. 6 in. for 196 columns. Each shaft is surmounted by a capital, 16 in. deep, flaring to 4 ft. 6 in. maximum diameter, upon which rests the dropped panel of the roof.

The roof slab is 10 in. thick and is reinforced in four directions with ½-in. round steel bars. Dropped panels 5½ in. deep and 8 ft. square over the columns increase the thickness to 15½



Crane *(at extreme left)*, handling bottom-dump buckets, places concrete mixed by paver

SECTIONAL FORMS

Covered Reservoir Job

in. At the walls, a fillet 18 in. deep and 3 ft. in horizontal dimension strengthens the corner of the roof. The roof slopes transversely from the center, dropping 6 in. from the ridge to the edge. Earth cover 2 ft. thick is placed over the roof.

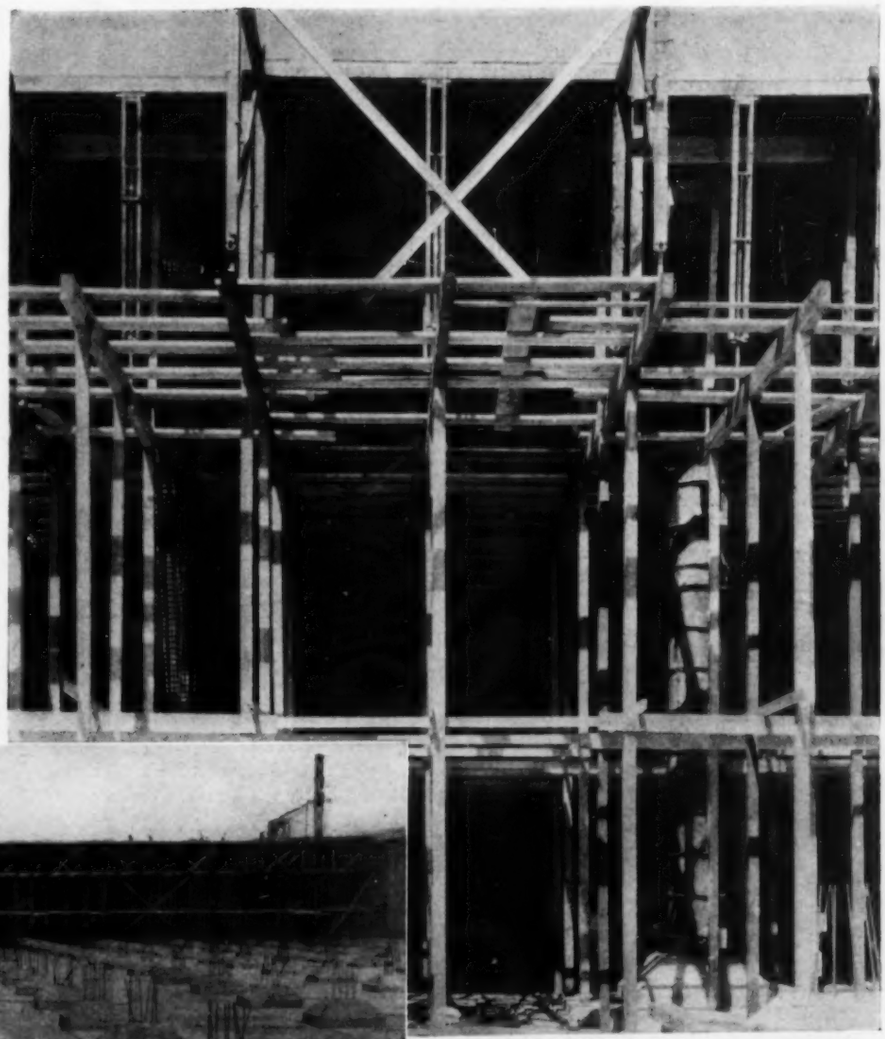
Quantities — Excavation included 6,000 yd. of topsoil, 36,000 yd. of earth, and 22,000 yd. of rock. Refill and embankments amounted to 52,000 yd. Footings and walls required 9,000 yd. of concrete; the 6-in floor, 2,110 yd.; and the column shafts, capitals and roof, 6,770 yd. Concrete reinforcement called for 2,100,000 lb. of steel bars, supplied by the Truscon Steel Co.

Central Batching Plant—Sand and slag were delivered by dealers' trucks to a Heltzel batching plant located centrally outside one of the end walls of the reservoir. The trucks dumped the aggregates through openings in a plank roadway into steel bins which discharged into hoppers for weight measurement. Ramps on both sides of the plant permitted through movement of dealers' trucks.

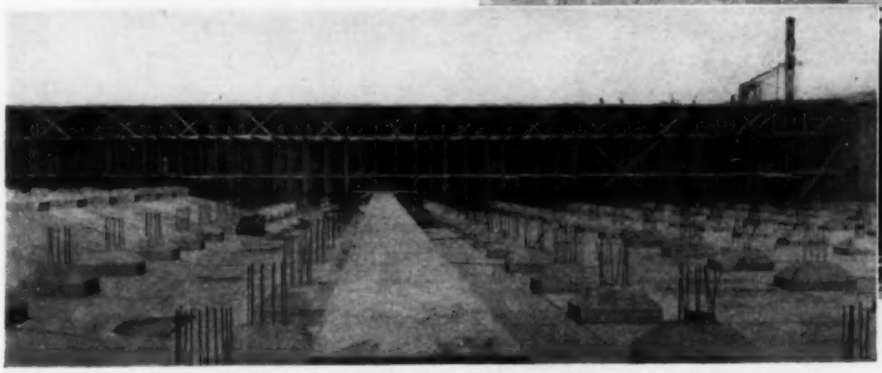
Hired batch trucks drove under the hoppers to receive the sand and slag and moved forward a few feet to the adjoining cement shed, where cement was dumped on top of the aggregates from counterweighted boxes. Sacked cement was hauled 16 miles by a trucking company from a cement plant at Bessemer, and was stored on a platform in the shed about 8 ft. above the roadway through the plant. Two men dumped the sacks into the counterweighted cement boxes, as shown in one of the photographs.

Wall Construction — Wall forms, made on the job, were large wood panels sheathed with steel plate. They were sturdily constructed for handling by crane and for repeated use.

The photograph at the head of the article illustrates the successive steps in the construction of the wall, which was built in alternate sections. After the reinforcing steel had been set with the aid of wood frames, the wall panels were erected by a P&H crane and were

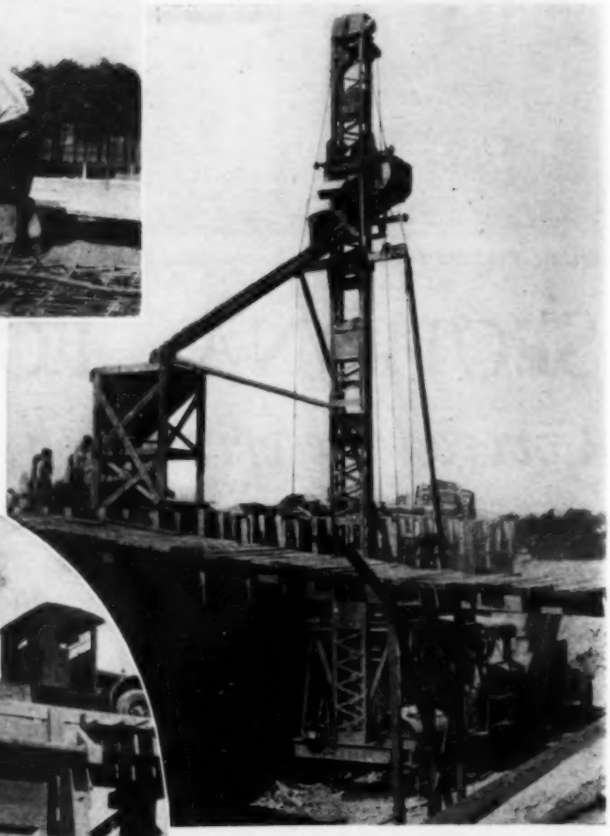


SHORING under deck forms consists of posts, stringers, and adjustable shores. Reinforcement in place for column at left, and steel form locked in position for column at right



ROOF AND COLUMN FORMS for more than one-sixth of reservoir area are erected at one time

PAVER-AND-MAST-HOIST PLANT *(below)* mixes concrete and elevates it to hopper on deck

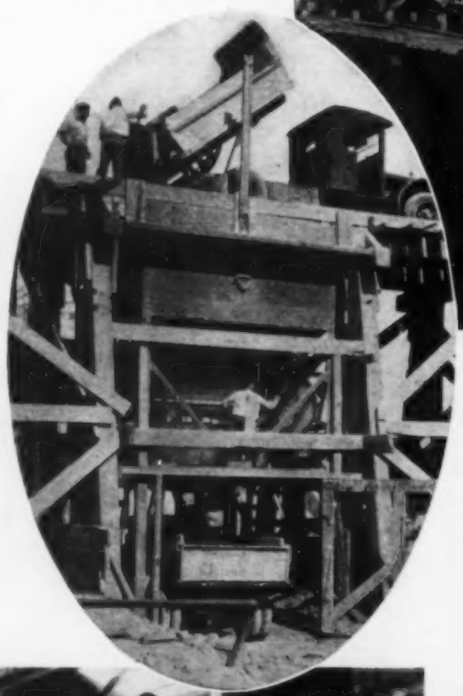


braced from the ground. A 1-yd. paver mixed the concrete at a point close to the forms and discharged the batches into 1-yd. bottom-dump buckets. The crane lifted the buckets to hoppers on top of the forms, from which concrete was distributed into the forms by elephant-trunk spouts. After the forms had been stripped, the concrete was covered with burlap kept wet for two weeks.

Column and Roof Forms — Forms for columns and roof were of a special type erected and stripped under subcontract by the Deslauriers Metal Mould Co., of Jersey City, N. J. The shaft forms consisted of semi-cylindrical steel plates locked together by steel-angle rings. Deck forms were wood panels sheathed with steel plate.

Sufficient deck forms were available to concrete a little more than one-sixth of the roof area at a time. The deck forms were supported on shoring which consisted of 4x4-in. posts about 20 ft. long, on 5-ft. centers, carrying 4x8-in. stringers on which rested adjustable Rooshors. Column reinforcing was fabricated on the job and was

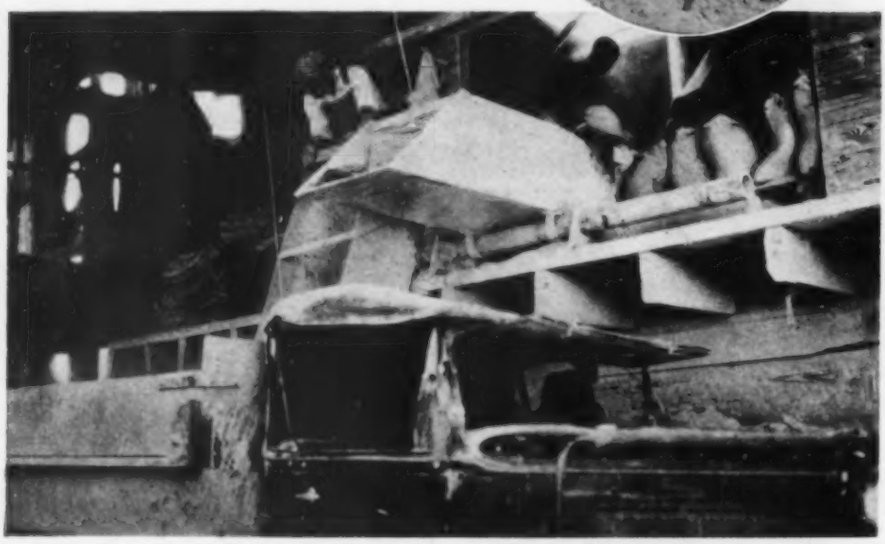
HAND CARTS *(above)* distribute concrete for columns and roof. Tampers work concrete into column form with long poles



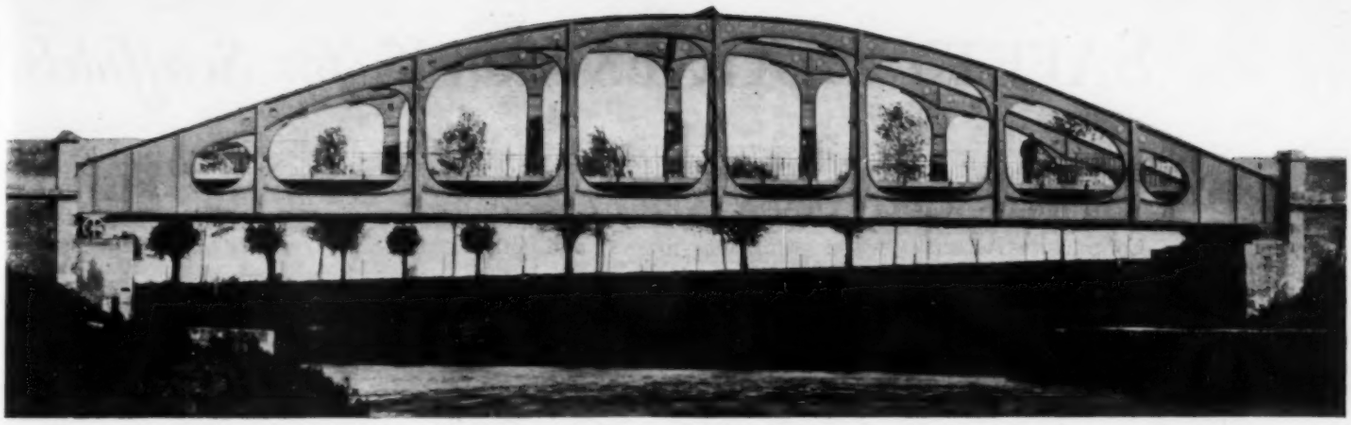
placed by a small A-frame hand hoist erected on the deck. Roof reinforcement was bent with Kardong tools and placed by hand on the deck.

Concreting Columns and Roof— Columns were poured ahead of the roof. Construction was carried forward lengthwise of the reservoir, working toward the batching plant. As the walls had been completed, concrete had to be mixed and elevated outside the structure. A mobile one-man Ransome unit, consisting of a 1-yd. paver and a mast hoist, mixed the concrete and delivered it to a floor hopper on the deck. The unit moved along the wall as the area of operations changed. Concrete was distributed from the floor hopper in Sterling 6-cu. ft. hand carts.

Administration — The distributing reservoir is one feature of a $9,000,000 plan being carried out by the Mahoning Valley Sanitary District to supply pure, soft water to the cities of Youngstown and Niles. In charge of investigations, design and construction for the district are W. H. Dittoe, chief engineer, and G. Gale Dixon, deputy chief engineer. At the reservoir, M. C. Kinder, division engineer, and J. M. B. Miskimen, assistant engineer, direct all operations. R. E. Weidman is superintendent for E. H. Latham & Co.



CEMENT is emptied from sacks into counterweighted boxes which dump on to aggregates in batch truck. AGGREGATES *(in oval)* move entirely by gravity, from delivery truck to batch truck

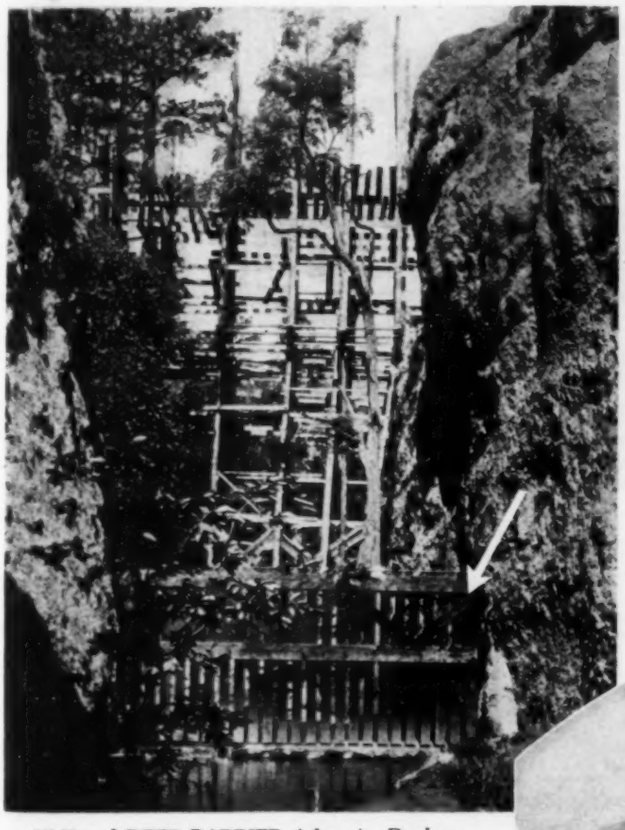


NO DIAGONAL MEMBERS are employed in this type of bridge, designed by Prof. A. Vierendeel, of the University of Louvain, Belgium. Supporting trusses are rigid rectangular or trapezoidal frames, producing a series of open panels. Longest span of this type is 236 ft., built in Belgian Congo in 1926

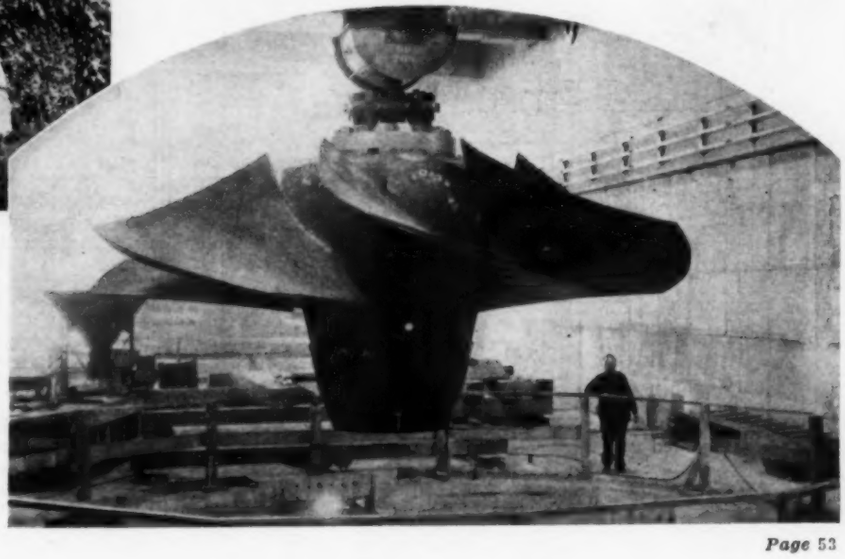
JOB ODDITIES

A Monthly Page of Unusual Features of Construction

SECOND STORY WORK, without police interference, is undertaken by this Universal truck-mounted crane used by Globe Wrecking Co., to demolish warehouse at new bridge approach in Vincennes, Ind.



ELK and DEER BARRIER *(above)*. During construction of bridge Northwestern Engineering Co., contractor, of Rapid City, N. D., maintained high wooden fence to prevent escape of animals from Custer State Park, South Dakota

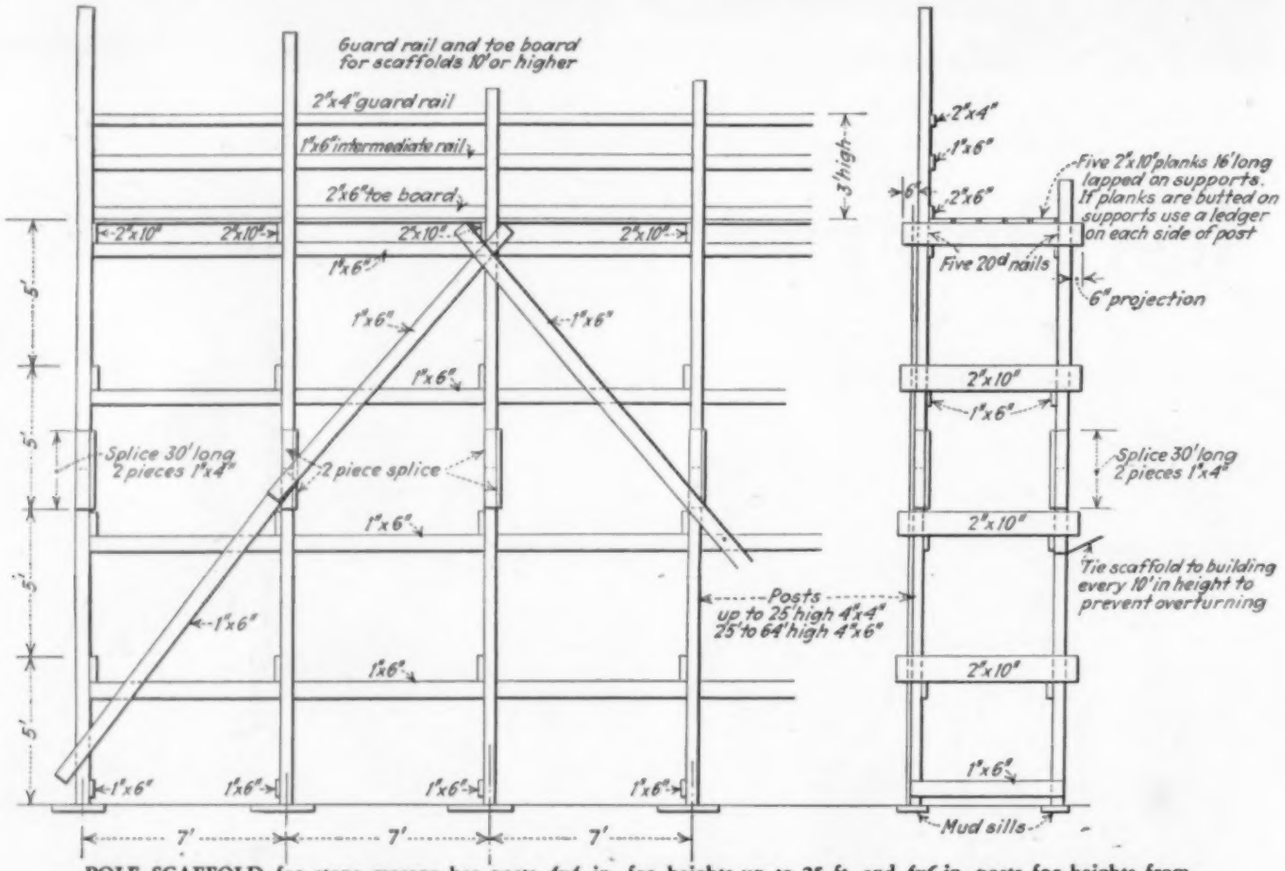


80-TON WATER WHEEL *(right)*. Adjustable blades are feature of unit to develop 21,000 hp. at Rock Island plant being built by Stone & Webster Engineering Corp. on Columbia River

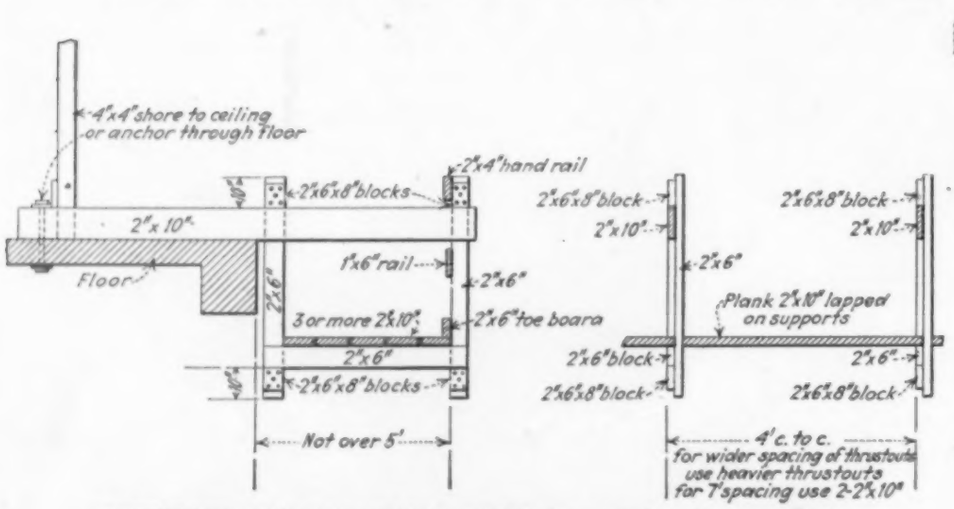
SAFETY SUGGESTIONS *for Scaffolds,*

OHIO'S new construction safety code, of which a digest has been prepared by a committee of the General Contractors Association of Cleveland, gives details of approved forms of ladders, scaffolds and outriggers, as illustrated in the accompanying drawings. The code requires that all lumber used for runways, scaffolds, towers and other temporary construction be No. 1 common yellow pine or its equivalent, free from such defects as ring shakes, cross grain loose knots or decay. A safety factor of four is specified for all temporary construction, appliances and equipment.

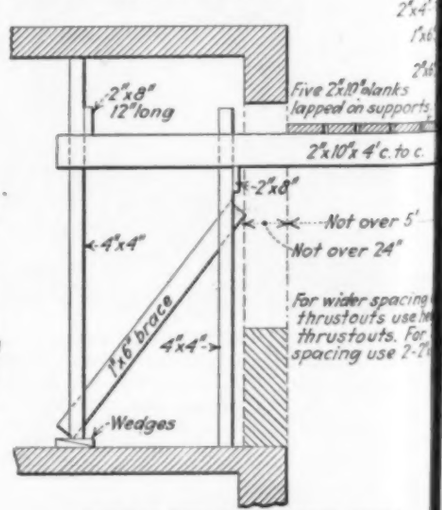
No runway may be built of less


Guard rail and toe board for scaffolds 10' or higher
2"x4" guard rail
1"x6" intermediate rail
2"x6" toe board
3' high
2"x10"
1"x6"
5'
Splice 30' long 2 pieces 1"x4"
2 piece splice
Posts up to 25' high 4"x4" 25' to 64' high 4"x6"
7'
Mud sills
2"x4"
Five 2"x10" planks 16' long lapped on supports. If planks are butted on supports use a ledger on each side of post
Five 20d nails
6" projection
Tie scaffold to building every 10' in height to prevent overturning

POLE SCAFFOLD for stone masons has posts 4x4 in. for heights up to 25 ft. and 4x6-in. posts for heights from 25 to 64 ft. Scaffold is tied to building every 10 ft. in height to prevent overturning. Guard rails and 2x6 in. toe boards required for scaffolds 10 ft. or more in height. Floor planking is 2x10 in. lumber, lapped on supports



OUTRIGGER SCAFFOLD FROM FLOOR has 2x10-in. thrustout planks anchored either by bolts through floor or 4x4-in. shores to ceiling. Overhang must not exceed 5 ft. Floor planks are 2x10's with 2x6-in. toe board. Thrustouts ordinarily spaced on 4-ft. centers; for wider spacings heavier thrustout timbers are required—two 2x10's for 7-ft. spacings

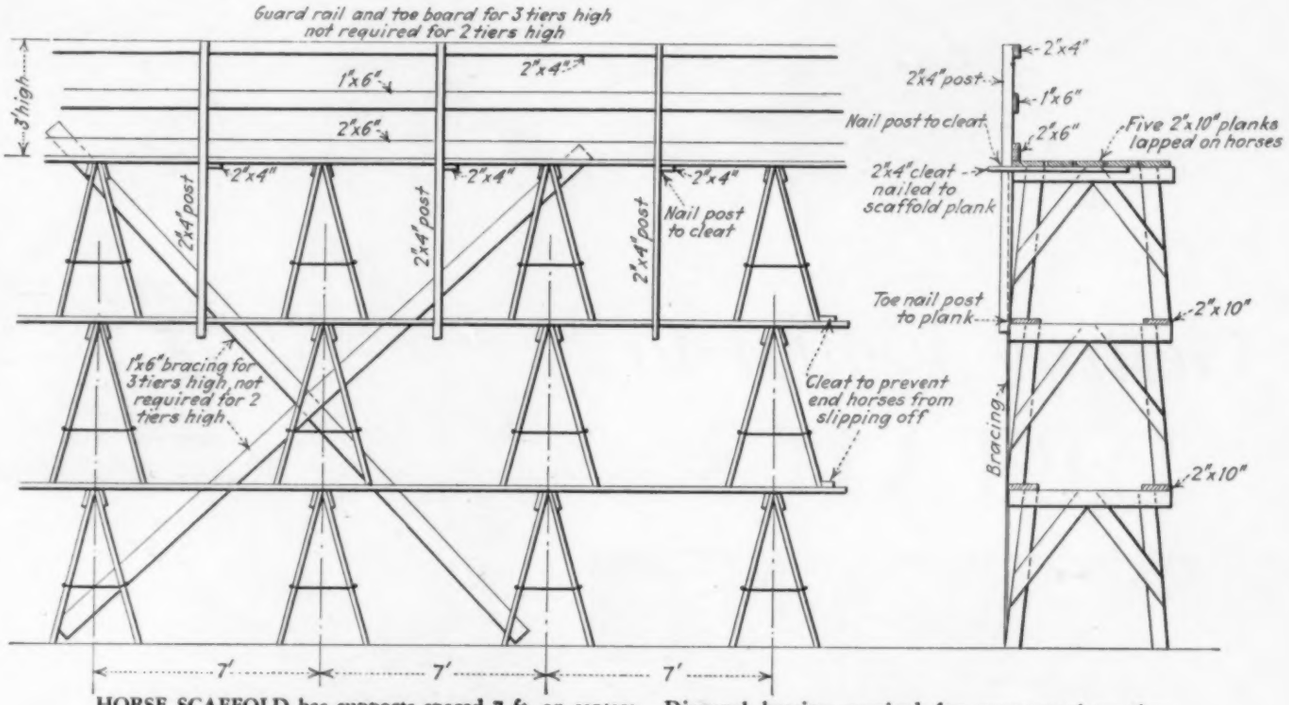


OUTRIGGER THROUGH WINDOW is similar in general construction to one at left. Posts of 4x4's are braced by 1x6-in. diagonal member

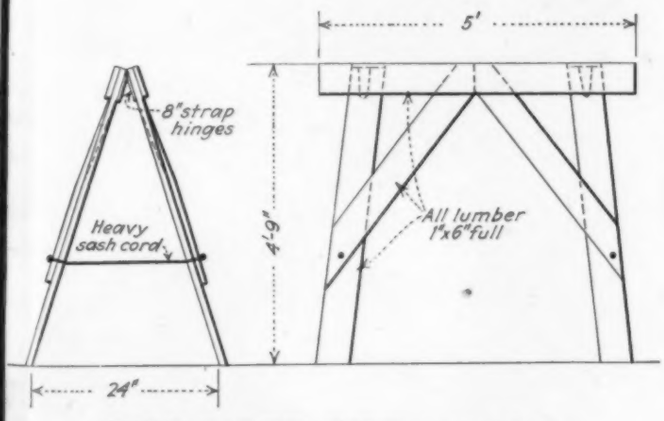
Ladders and Horses on Construction

than two 2x10-in. planks; wherever wheelbarrows are to be used, runways shall consist of three 2x10-in. planks. Runways must be supported every 7-ft. and must not have a steeper inclination than 1 on 3. Cleats are required on runways having a pitch of 1 on 5 or steeper. In no case may a plank extend more than 4 in. beyond the end bearer.

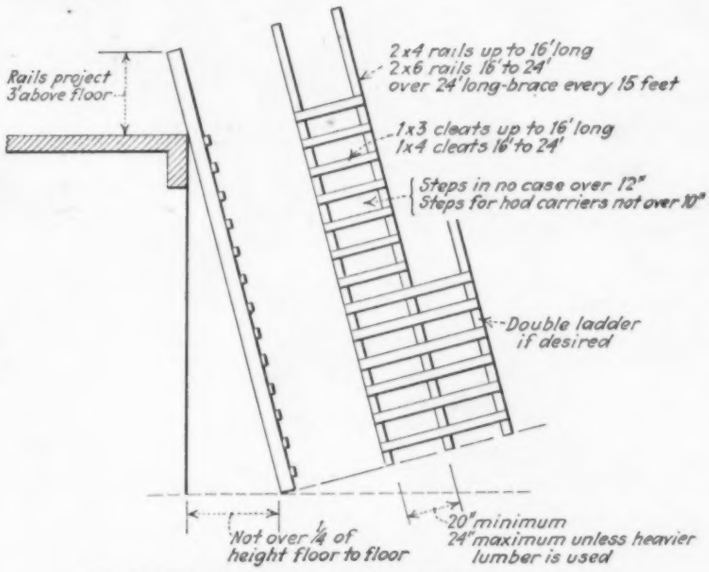
Discarded packing boxes, barrels, piles of loose lumber or other makeshift materials shall not be used as supports for scaffolds. Ladders may be of the cleat or rung types. For hod carriers height of ladder step must not exceed 10 in.; in other cases, height of step shall not exceed 12 in. Ladder landings must be at least 24 in. wide. If a vertical ladder is longer than 30 ft., a landing or rest platform must be provided for each 30 ft. of height unless a safety cage is furnished.



HORSE SCAFFOLD has supports spaced 7 ft. on centers. Diagonal bracing required for structure three tiers high. Cleats prevent end horses from slipping. Guard rail and toe board for three tier high scaffold not required for two tiers. Flooring consists of five 2x10-in. planks, lapped on horses



DETAIL OF WOOD HORSE constructed of 1x6-in. lumber. Height 4 ft. 9 in.; width, 5 ft. Lumber specified is No. 1 common yellow pine or its equivalent, free from defects

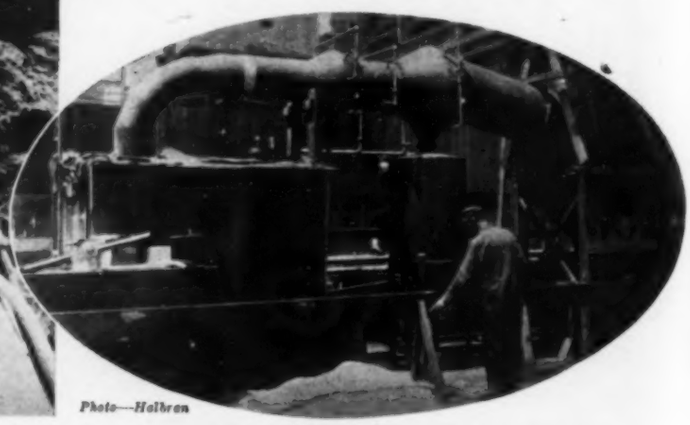

Rails project 3' above floor
2x4 rails up to 16' long
2x6 rails 16' to 24' over 24' long-brace every 15 feet
1x3 cleats up to 16' long
1x4 cleats 16' to 24'
Steps in no case over 12"
Steps for hod carriers not over 10"
Double ladder if desired
Not over 1/4 of height floor to floor
20" minimum
24" maximum unless heavier lumber is used

APPROVED TYPE OF CLEAT LADDER, either double or single. Height of step 10 in. for hod carriers and 12 in. for other uses. Ladder rails extend 3 ft. above floor landing. If a vertical ladder is longer than 30 ft., a landing or rest platform must be provided for each 30 ft. of height unless a safety cage is furnished

WOVEN LUMBER MATTRESS is constructed as revetment for bank of Missouri River. Material used is 1x4-in. planks at least 12 ft. long

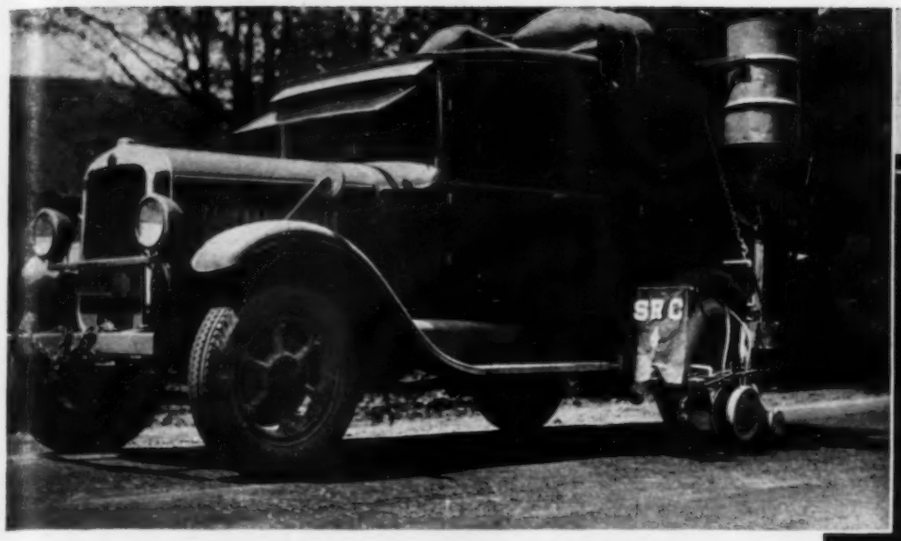
Getting Down to DETAILS

SHEET PILE EXTRACTION by Philadelphia Electric Co. is handled by portable gallows frame and a pair of hand-operated Puljacks. With rig shown and crew of 5 men, one 2x12-in. by 20-ft. plank pile was pulled every 5 min. Jack has two speeds

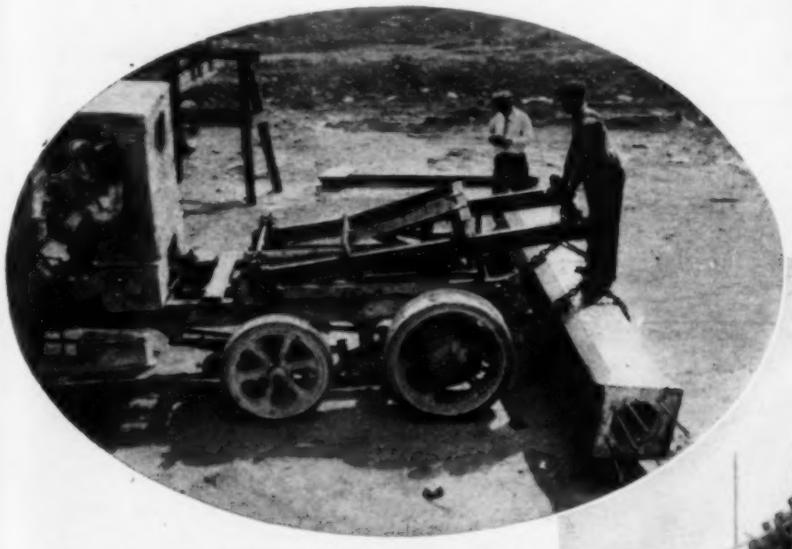


Photo—Halbran

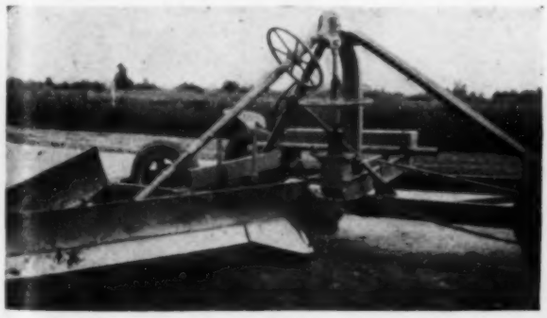
DUST COLLECTORS around drill steel *(left)* eliminate rock dust from drilling for new Metropolitan Life Insurance Co. building, New York City. Suction hoses each day gather 8 tons of dust, including invisible particles which are most dangerous cause of silicosis, from 60 drills in use on job. George S. Kelley, of George J. Atwell Foundation Corp., invented device. Dust is delivered to containers *(at right)*



BLOTTED TRAFFIC-LINE MARKINGS, across which vehicles may pass without smearing freshly applied paint, are produced by this machine *(above and at right)*, developed by the State Road Commission of West Virginia. Sawdust, distributed uniformly from nozzle by screw feed, protects wet paint lines from damage



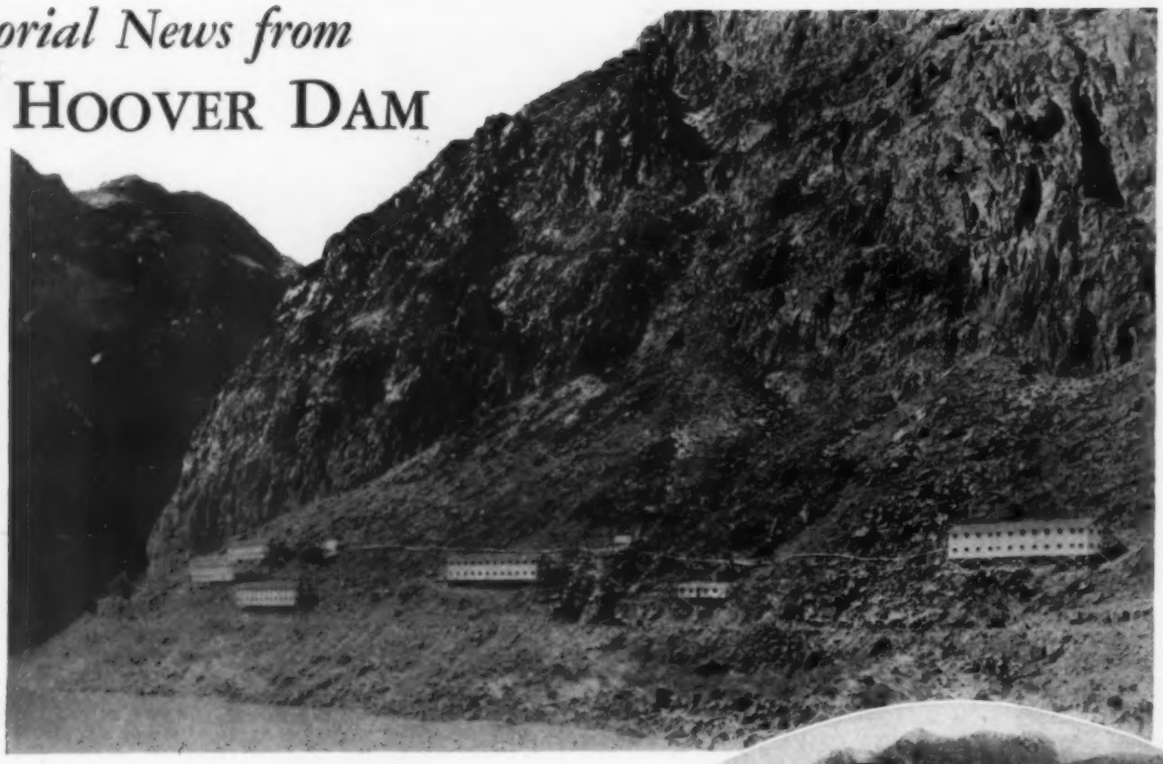
FOR TRANSPORTING PILE JACKETS to California pier construction job, M. B. McGowan, San Francisco contractor, uses truck dumping hoist and chain slings, as illustrated. Concrete jackets are each 15 ft. long and weigh 2 tons



SPECIAL TRENCH BLADE for metalled road shoulders is used by Cunningham Construction Co., of Indianapolis, Ind. New Insley shoulder finisher has grader blade designed to make cut 6 in. deep, 18 in. wide at top and 6 in. wide at bottom. Cut is filled with crushed stone, creating solid shoulder

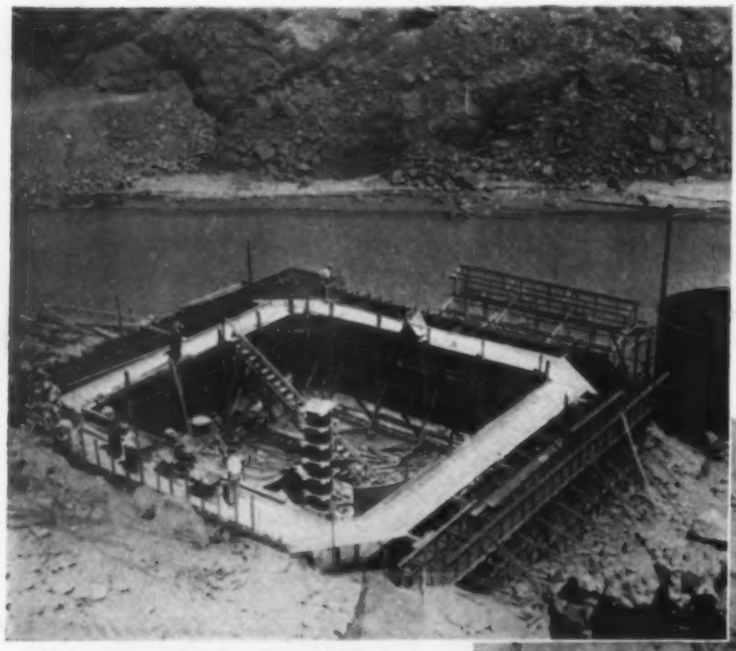
FORM AND STEEL CENTERING DETAIL for 460-ft. concrete arch span of Westinghouse bridge, under construction by Booth & Flinn Co., at East Pittsburgh, Pa. Forms were made watertight by using tongue-and-groove lumber and 3-ply veneer board lining

Pictorial News from HOOVER DAM

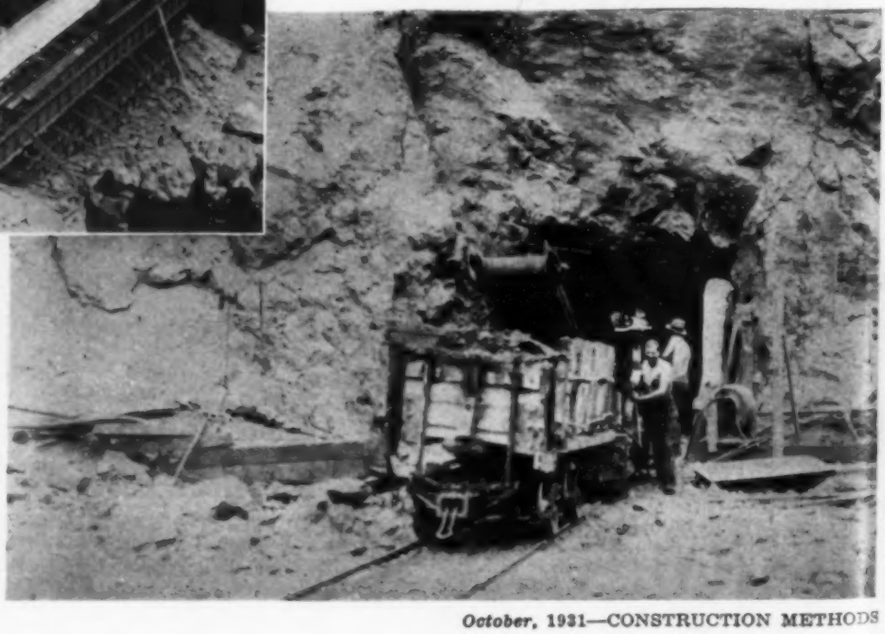


BUNK HOUSES and large mess hall for employees of Six Companies, Inc., the contractors, are perched on the lower wall of the Colorado River canyon near the site of the Hoover Dam

SURFACING is being completed by blade grader on oiled gravel road leading from Boulder City, Nev., to the damsite



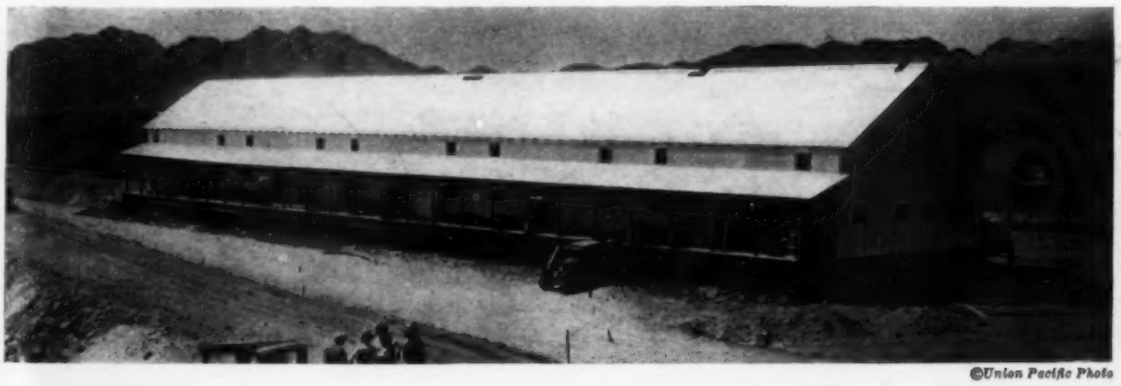
CONCRETE FOUNDATION is being poured for plant to treat Colorado River water by Dorr clarifier before it is pumped to Boulder City for domestic use by construction personnel



TUNNEL MUCKING MACHINE *(right)* is withdrawn from one of the 12x12-ft. headings while blast is fired

Photos by W. A. Davis, Las Vegas, Nev.

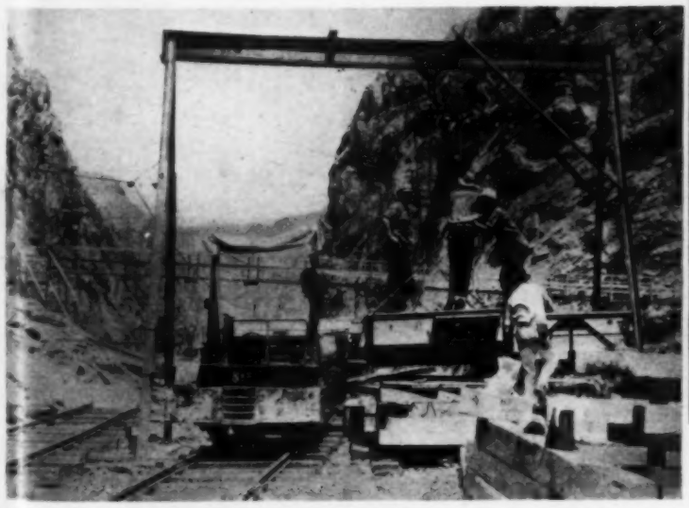
DAMSITE on Colorado River shows evidence of construction progress. Two wire cable suspension bridges carry compressed air lines across stream. Compressor plant *(in left foreground)* is being installed. Roadway *(left, center)* is being built along side of canyon



©Union Pacific Photo

WAREHOUSE *(left)*, 200 ft. long and 32 ft. wide, has been built by contractors, with 8-ft. loading platforms on both sides served by tracks of Union Pacific Railroad

STEEL GANTRY *(below)* with chain-block hoist removes for recharging and replaces heavy electric storage batteries for operating locomotives which haul muck from tunnel headings



ELECTRIC POWER SHOVEL is being assembled to excavate and load material from diversion tunnels. Shovel parts were brought to site by motor truck

To Produce Good Concrete

FORMS MUST BE WATERTIGHT

BY GEORGE HOCKENSMITH

Vice-President
Booth & Flinn Co., Inc.,
Pittsburgh, Pa.

CONCRETE frequently disintegrates in cold climates. After making numerous experiments and tests, I have concluded that the fundamental cause is *not* that the concrete has been poured in cold weather, as concrete placed in the summer disintegrates as badly as that poured under unfavorable winter conditions. The real cause is to be found in the porous surface of the disintegrating concrete.

On any job where concrete disintegrates one will find that the forms have been built in rough fashion, with cracks in the corners and between the boards from $\frac{1}{16}$ in. to $\frac{1}{2}$ in. wide. These cracks permit the mortar and water to leak out, leaving porous concrete at every crack. A magnifying glass discloses hundreds of pinholes penetrating 4 or 5 in. into the concrete. Each tiny stream of leakage leaves its pinhole extending into the heart of the concrete. The same phenomenon occurs whether concrete is poured in summer or winter.

When cold weather comes, with fogs or rain during the day and freezing temperatures at night, the pores fill with water. During cold nights the water freezes into ice and expands, fracturing the concrete. The first fracture will not appear to the naked eye; but the second and third freezes will spall the concrete slightly. After a couple of seasons of freezing and thawing, the concrete will break loose and drop out to a depth of 2 or 3 in.

Leaking Forms—Every construction man has seen concrete jobs on which water has run and dripped off the forms. This escape of water indicates either that the forms leak or, possibly, that the concrete is too wet. To prevent the disintegration of concrete forms must be watertight and the batch must be mixed with a minimum water ratio. No water should leak through the forms. All of it should be taken up in chemical combination during the setting of the cement. If forms are watertight examination of the concrete will reveal no pores or pinholes, and the danger of freezing and cracking will be eliminated.

Great care should be given to the formwork and to the proper working of the concrete while it is being placed. Forms should be constructed of tongue-and-groove lumber, and all joints should be made watertight.

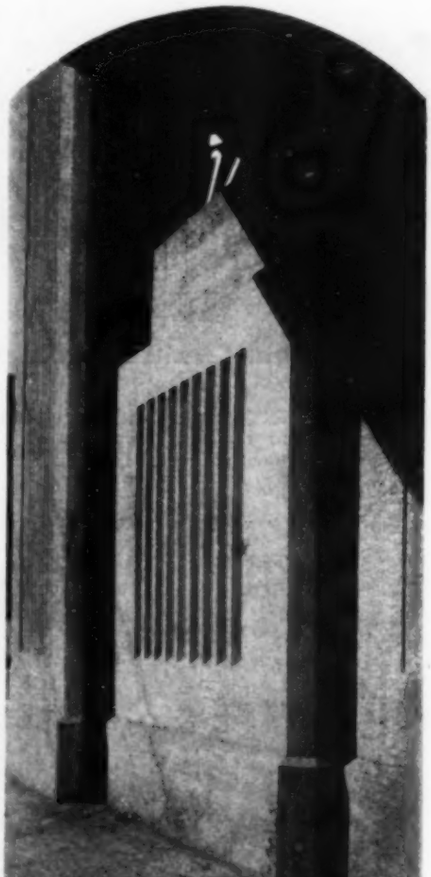
Disintegration of concrete usually starts on the square edge of a beam or column. It is almost impossible to ram concrete in a square-corner form sufficiently tight to eliminate pores. To avoid this difficulty a chamfer strip at least 2 in. wide across the face ought to be placed in all square corners.

Concrete, if poured and tamped properly in watertight forms of correct design, has a smooth surface covered with a thin film of mortar. Breaking this film exposes the pores and leaves the concrete liable to disintegration. Many architects and engineers specify that concrete surfaces shall be rubbed with carborundum stones, either by hand or by power. This rubbing injures the concrete by destroying the protective film. A slight scaling of the surface is always observable on rubbed concretes in cold climates.

If forms are properly built, with good lumber, the concrete surface ought to be smooth and free from fins and honeycomb. It would seem advisable, therefore, to eliminate rubbing from concrete specifications and to require that forms and placing methods be such as to leave a smooth concrete surface with a dense film of mortar which needs no retouching.

For the last four years we have lined with $\frac{1}{4}$-in. three-ply veneer all forms for concrete exposed to the weather, thereby preventing leakage through cracks and insuring a smooth, dense surface. Specifications should cover the kind of material, number of times lumber may be used and other details of good form construction. The writer believes that the precautions above outlined can be depended upon to prevent concrete disintegration.

LEAKING FORMS produce rough, porous surface subject to disintegration



WITH WATERTIGHT FORMS a dense, smooth concrete surface is produced

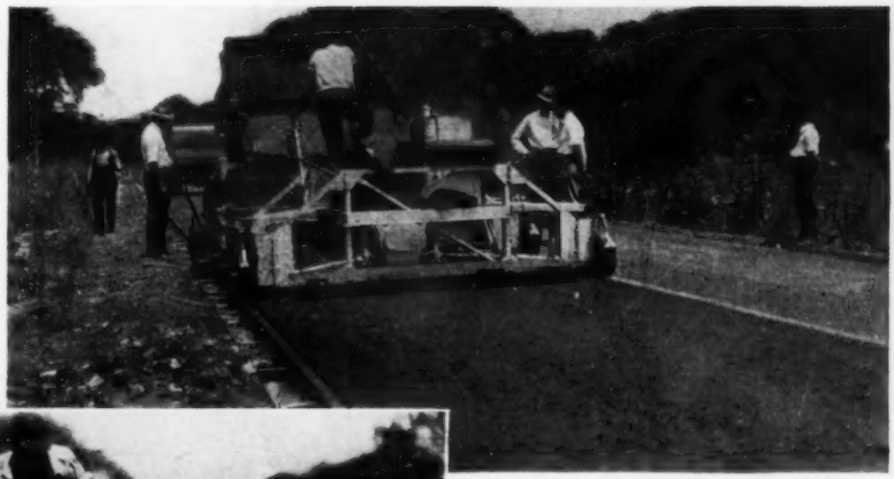
MACHINE FINISHING

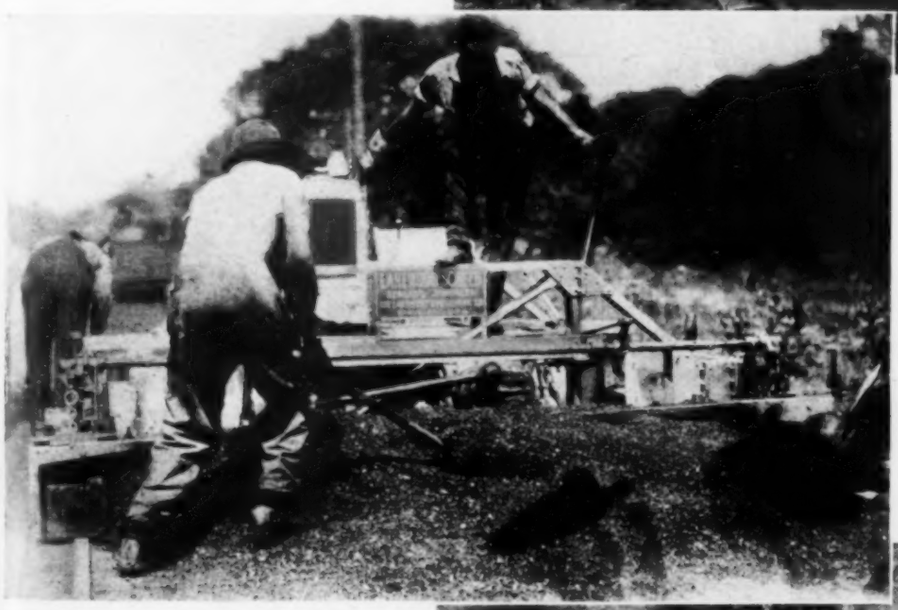
for Black Top Pavement

FOR the first time in Ohio mechanical finishing has been applied to black-top paving in half widths by the Federal Asphalt Paving Co. of Hamilton, on the state route between Hanover and Newark. A feature of the work, which is two-course construction, is the effort to produce a smooth riding paved surface by the use of 3-in. steel forms with 8-in. base and slide lock, to support a Lakewood finishing machine. As a preliminary, all large depressions were filled by means of a leveling course which brought the subgrade to a uniform elevation before the binder course was deposited.

The first part of the 20-ft. road was paved in half widths; later, full-width construction was employed, using a spreader box on the rear end of the truck which delivered the hot bituminous mixture. The capacity of the bituminous mixing plant limited production to approximately 325 tons in 8 hours with the following labor gang: *On base course,* 4 shovelers, 1 machine operator, 1 back raker. *On top course,* 3 shovelers, 1 machine operator, 1 back raker, 1 man handling compression strips.

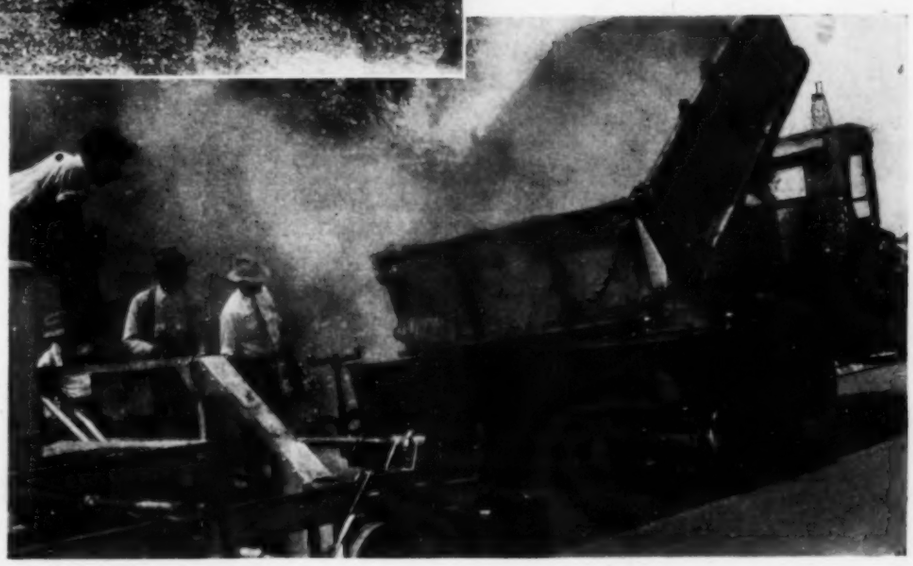
Only a slight change in the screed of the finishing machine, designed primarily for concrete paving, was necessary to adapt it to the black-top work. Adjustable end shoes make possible the raising or lowering of the center section of the screed of the finishing machine. The screed is held in a slightly tilted position in order to give added compression to the bituminous material and to reduce the amount of rolling.





STEEL FORMS *(above),* 3 in. high, carry finishing machine on half-width construction of top course. Compression strips are used in conjunction with spreading mixture for top course. Flat-tired wheel carries end of finishing machine along previously completed half-width section

FINISHING MACHINE *(left)* spreads material for base course on half-width work. Later, construction was carried on in full 20-ft. width



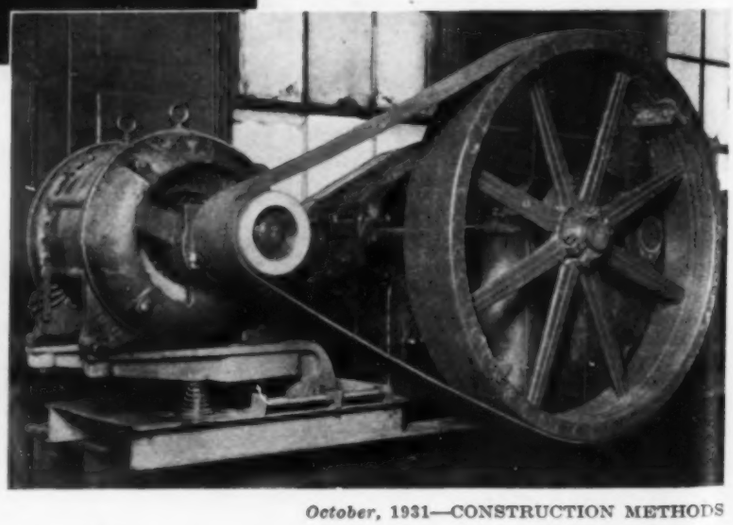
SPREADER BOX receives discharge of bituminous mixture from motor truck and distributes it uniformly. Adjustable end shoes on asphalt screed make it possible to raise center section to allow for compression of paving mixture

NEW EQUIPMENT *on the Job*

CLAMSHELL BUCKET for hard digging features double-fulcrum two-lever closing arms attached to both shells which force bucket into material, assuring full load every trip. Cutting edges and shape of shells designed to dig without resistance and to dump sticky material freely.—Joseph F. Kiesler Co., Chicago, Ill.

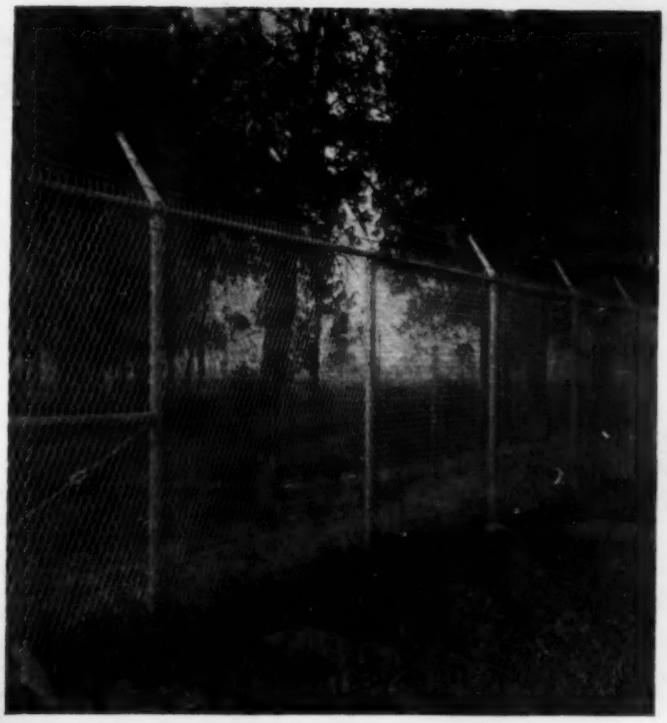
ROAD ADJUSTER for attachment to any standard road grader 8 ft. or larger, consists of two mold boards fastened V-shape to a 24-ft. straight edge equipped with a shoe and $\frac{1}{16}$-in. steel shims which can be removed to adjust wear on cutting edge. Use of spirit level enables operator to adjust road from level to any desired crown. — Gledhill Road Machinery Co., Galion, Ohio

ALUMINUM ALLOY BOOM, for use with giant dragline excavator, weighs one-half as much as steel boom of equivalent length and strength. Use of boom assures less working weight on jobs where footing is unstable, provides greater range in handling material and allows use of bucket of greater capacity, Marion Steam Shovel Co., Marion, Ohio

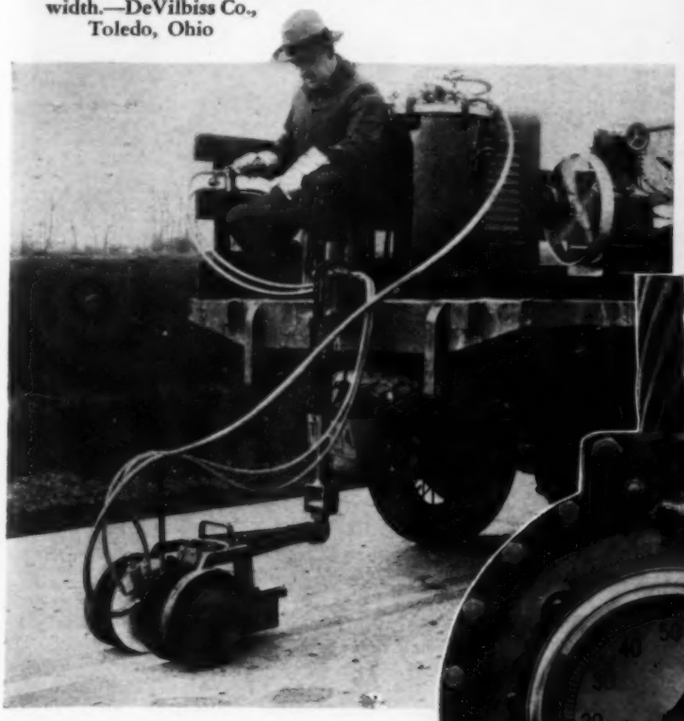


SHORT-CENTER BELT DRIVE *(right)* utilizes gravity and weight of motor to maintain uniform tension at all speeds in a flat leather belt. Motor for Rockwood drive is mounted on hinged base. Center distance changes as belt changes. —Chicago Belting Co., 113 North Green St., Chicago

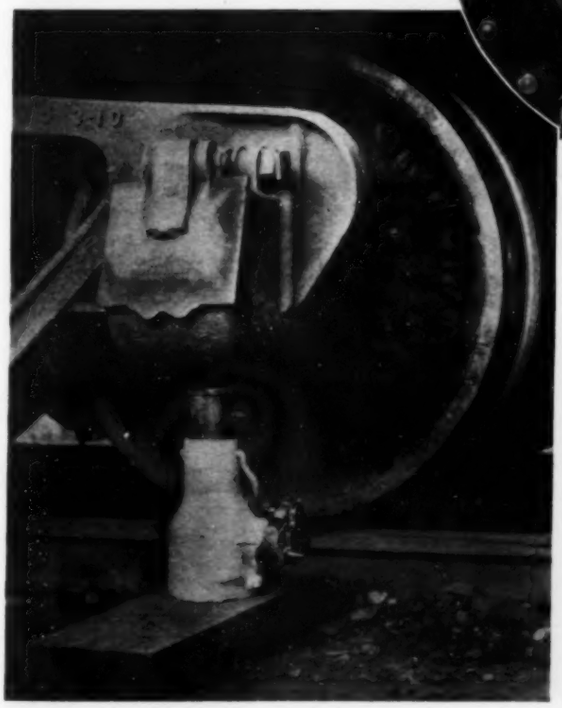
ALUMINUM WOVEN FIRE FENCE *(right)* is non-corrodable and does not require periodic painting to keep it in condition. Other features: strength to withstand ordinary impact; ease of erection; low maintenance cost, and decorative value.—Page Steel & Wire Co., Bridgeport, Conn.

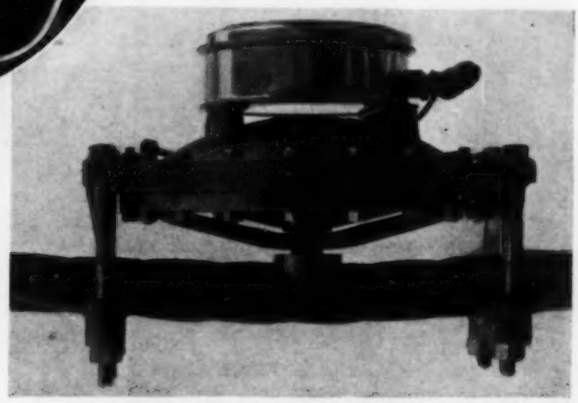


HIGHWAY STRIPING OUTFIT *(below)*, attached to rear of truck or to right or left running board, spray-paints traffic line stripe on highways at speed of 6 to 8 miles per hour, using about 7 gal. of paint per mile. Automatic spray gun is operated by a hand controlled valve and mounted on an arm between two metal disks which insure a uniform stripe and are adjustable from 4- to 6-in. width.—DeVilbiss Co., Toledo, Ohio



TENSION INDICATOR *(at left and below)* clamped directly to wire cable, measures load by deflection principle without need of dead-ending or slack. Made in two sizes: Standard 11½-lb. model measuring load on any wire line between ¼ in. and ¾ in. in diameter up to 16,000 lb.; and heavy duty 43-lb. model from ¾ in. to 2⅜ in. in diameter up to 260,000 lb. Slight offset is made in line between two fixed points and force required to make or maintain this offset is shown on the gage—a direct indication of the line load. By use of calibrated line, any pulling load may be measured. —Martin-Decker Corp., Long Beach, Calif.





LIGHT-WEIGHT ALUMINUM JOURNAL JACK *(left)* for contractors' use. Two sizes: 15-ton weighing 19 lb., and 25-ton, 26 lb. Saving in weight made possible through use of heat-treated, aluminum alloy sand casting as a housing for steel lifting mechanism. Aluminum alloy shell highly resistant to atmospheric corrosion. — Duff-Norton Manufacturing Co., Pittsburgh, Pa.

Present and Accounted For —

A Page of Personalities

©Harris & Ewing

LIEUT.-COL. DAN I. SULTAN, Corps of Engineers, U. S. Army, in charge of surveys for the proposed Nicaragua interoceanic canal, has received from the President of the Republic of Nicaragua a medal of distinction in recognition of services characterized as "invaluable, sincere and loyal"

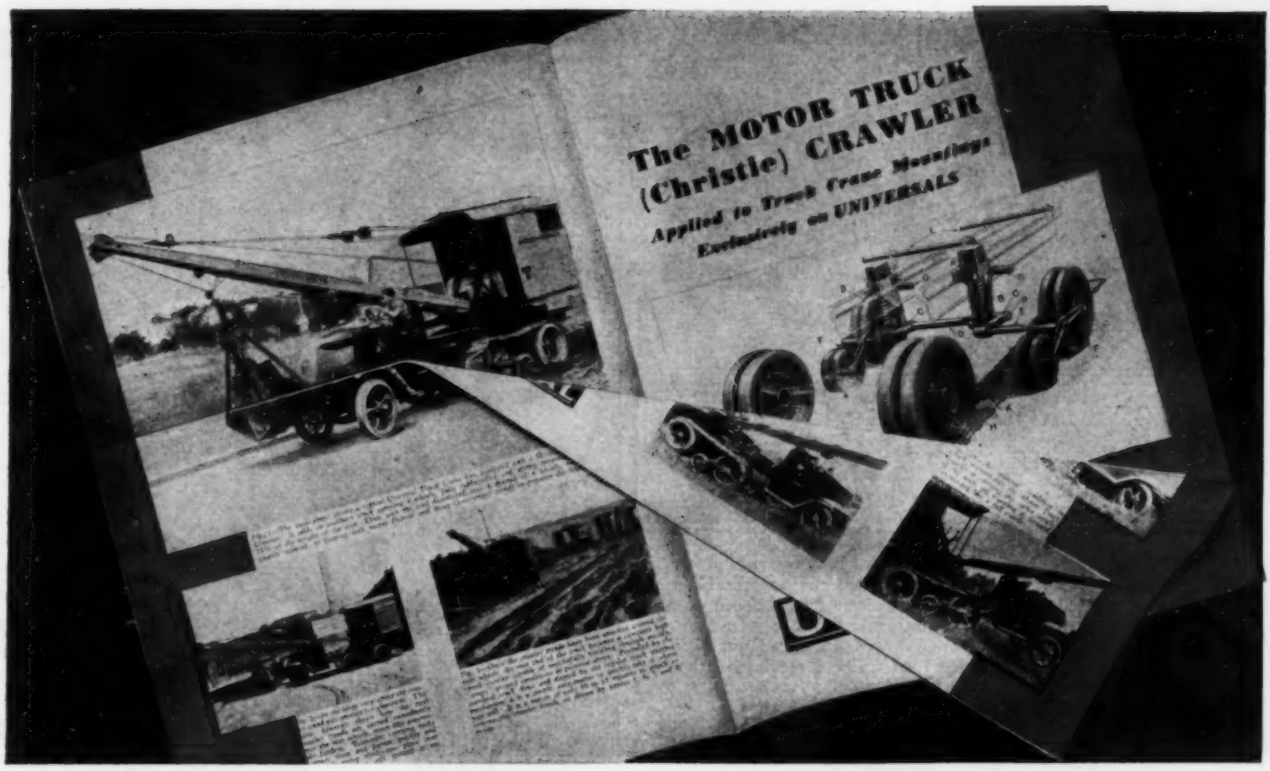
©Blank & Stoller

HENRY W. LOHMAN, first vice-president of James Stewart & Co., Inc., general contractors of New York, is serving another term as chairman of the Committee on Accident Prevention of the Building Trades Employers' Association of New York City

O. H. KOCH, member of the firm of Koch & Fowler, consulting engineers, of Dallas, Tex., has been appointed Director of Public Works of Dallas

MAJOR WILLIAM S. POST *(below)*, of Los Angeles, for many years identified with hydraulic engineering in California, has been appointed by Secretary Wilbur, of the Department of the Interior, director of irrigation in the Indian Service

HENRY H. BLOOD, chairman of the State Highway Commission of Utah, is completing his year's term as president of the American Association of State Highway Officials



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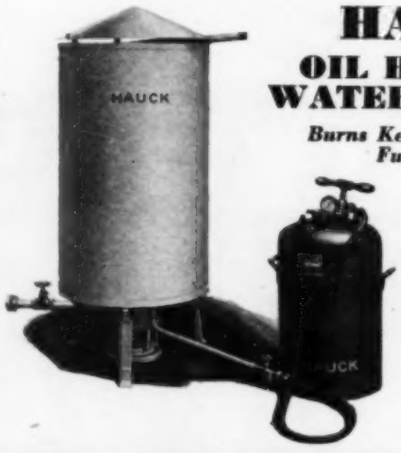

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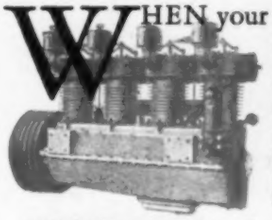

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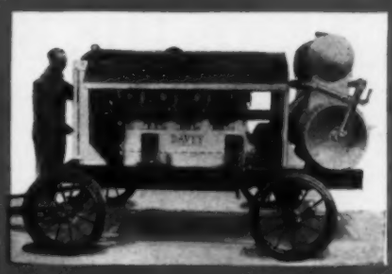

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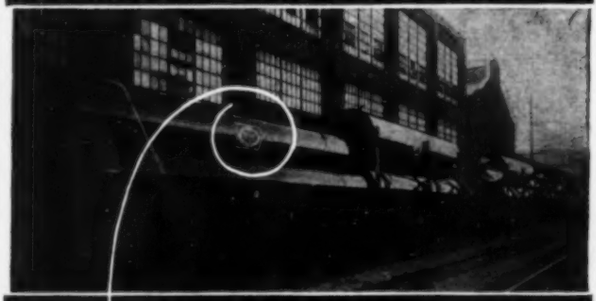

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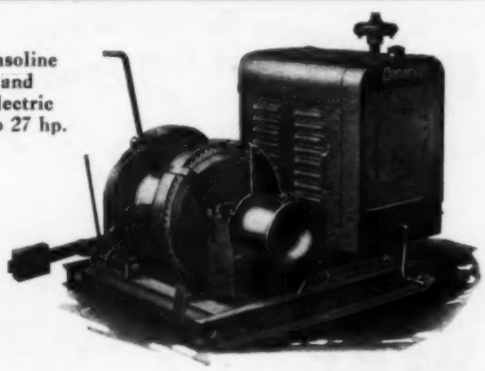

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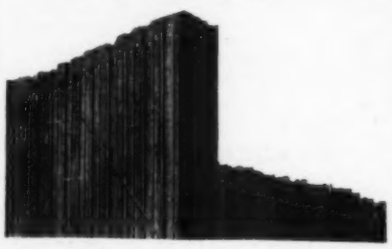

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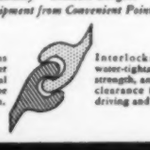

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	Page
American Cable Co.	10
Austin Western Road Machry. Co.	Insert 17-18
Autocar Company	4
Bay City Shovels, Inc.	22
Biggs Boiler Works Co.	68
Blaw-Knox Company	3
Bucyrus-Erie Co.	9
Calcium Chloride Publicity Committee	72
Caterpillar Tractor Co.	25
Cleveland Tractor Co.	4th Cover
Columbia Alkali Co.	72
Consolidated Iron & Steel Co.	71
Dake Engine Co.	71
Davey Compressor Co., Inc.	67
Dietz Company, R. E.	69
Domestic Eng. & Pump Co.	74
Dow Chemical Co.	72
Du Pont de Nemours & Co., E. I.	24
Firestone Tire & Rubber Co.	29
Hauck Mfg. Company	66
Hercules Powder Company	69
Hydrauger Corp., Ltd.	68
Inland Steel Company	3rd Cover
International Cement Corp.	6-7
Leschen & Sons Co., A.	13
Linde Air Products Co. (Unit of Union Carbide & Carbon Co.)	2nd Cover
Lincoln Electric Co.	12
Link-Belt Company	44-45
Lowell Wrench Co.	68
McGraw-Hill Book Co.	66-70
Northwest Engineering Co.	5
Novo Engine Company	11
Owen Bucket Co.	19
Ransome Concrete Mchry. Co.	8
Reed-Prentice Corp.	72
Riddell Co., W. A.	70
Schramm, Inc.	16
Searchlight Section	73
Solvay Sales Corp.	72
St. Regis Paper Co.	71
Thew Shovel Co.	23
Toledo Pressed Steel Co.	69
Toledo Wheelbarrow Co.	72
Universal Atlas Cement Co.	30
Universal Crane Co.	65
Vulcan Iron Works	14
Williams Co., G. H.	70
Worthington Pump & Mchry. Corp.	26-27

▼ ▼ ▼

SEARCHLIGHT SECTION

Classified Advertising

Classifications	Page
EMPLOYMENT	73
BUSINESS OPPORTUNITY	73
USED AND SURPLUS EQUIPMENT	
Foster Co., L. B.	73
Hyman-Michaels Co.	73
Overlook Machinery Sales	73
Wemlinger, Inc.	73

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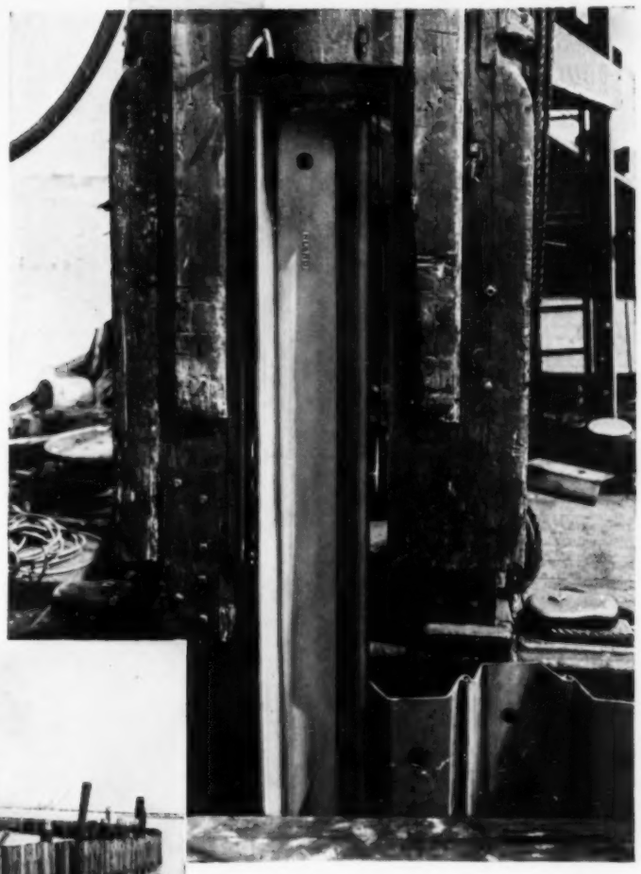
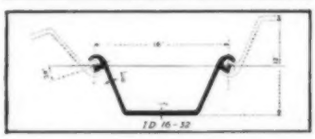
THE FIRST INLAND PILING

"Perfect in Every Detail"



Left—The first installation of Inland Sheet Piling, (Section ID 16-25), the dock wall at Montrose Ave. Harbor, Lincoln Park, Chicago. Fitzsimons & Connell Dredge & Dock Company, Contractors. Above—Driving a section of piling on the same job.



Section No.	Width	Lbs. per Sq. Ft. of Wall
ID 16-25	16″	25
ID 16-32	16″	32
IA 15-34	15″	34

"Inland's Piling rendered perfect performance in every detail." These are the words of the man in charge of the installation of the first order for Inland Steel Sheet Piling, a veteran who has handled all types of Piling on countless applications over a long period of time.

His sentiments have been echoed by others, well pleased with the driving ability, the strength of interlock—the *high quality of Inland's Sheet Piling.*

Inland is now equipped to furnish three Piling Sections—two of the deep arch type—ID 16-25 (16″ wide, 25 lbs. per square foot of wall) and ID 16-32 (16″ wide, 32 lbs. per square foot of wall) and one of the arched web type—IA 15-34 (15″ wide, 34 lbs. per square foot of wall.) Other sections are to be added, so that the Inland line will soon be complete.

Details of the sections will be furnished on request and Inland would welcome the opportunity of discussing your Piling problems with you. INLAND STEEL COMPANY, 38 S. Dearborn Street, Chicago, Illinois.

INLAND STEEL

ABLE SERVANT OF THE CENTRAL WEST

Sheets Bars Plates Structurals Piling

Rails Track Accessories Bands Rivets Billets

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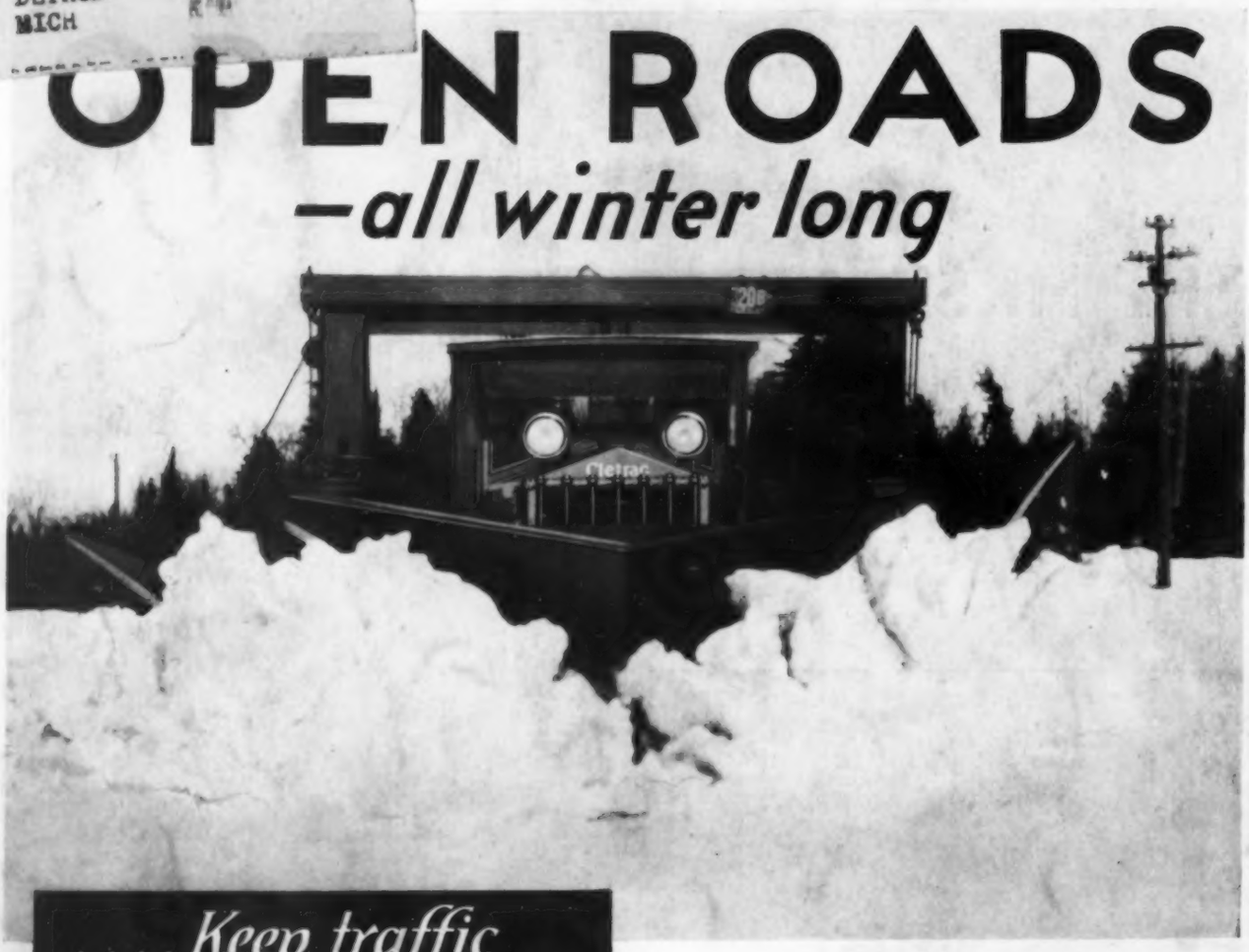
OPEN ROADS
—all winter long



. . . . Keep traffic moving and business going with Cletracs

WHEN winter snows pile up across roads and highways, isolating homes and towns and menacing lives, property and business, there is only one sure way to meet the threat. Modern, efficient snow fighting equipment is the only reliable weapon that can give sure protection.

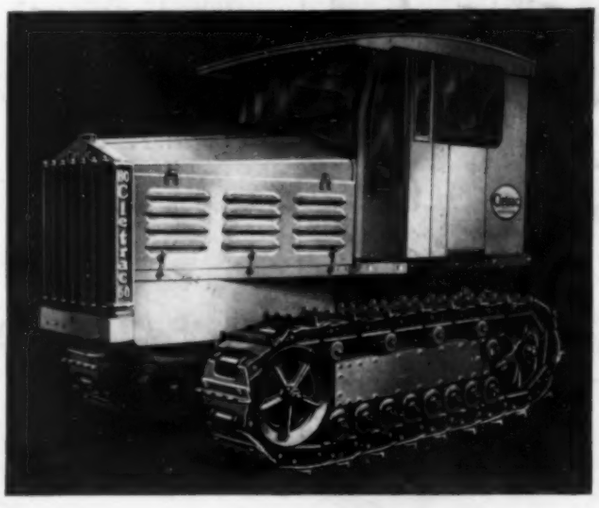
• • •

Throughout the big snow-belt Cletrac Crawler Tractors are the recognized power units for carrying on this increasingly important winter job. They are built, powered and armored for such heavy-duty service. Broad, sure-gripping tracks for unslipping traction. High power efficiency for handling big plows. Fast travel for quick clearing. Economical operation. Sturdiness. Usefulness for other road work when summer comes. These are just a few of the features that make Cletrac Crawlers the soundest possible investment for public departments or contractors handling the snow removal job.

CLETRAC
CRAWLER TRACTORS

Cletracs are adapted for ready attachment to various makes of snow plows, of both the rotary and regular push types. Enclosed cabs and special ice-cleats (both removable) are optional equipment on all models.

• • •

Prompt and expert service is available through your Cletrac distributor. See him for a demonstration or write direct for complete information.

THE CLEVELAND TRACTOR COMPANY
19323 Euclid Avenue Cleveland, Ohio